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A MONTHLY MAGAZINE

OF

FORESTRY.

EDITED BY

W. R. FISHER, B.A.,

DEPUTY DIRECTOR, FOREST SCHOOL, DEHRA DUN.

FEBRUARY, 1884.

X 143

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THOS. D. BONA, SUPERINTENDENT

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THE

INDIAN FORESTER.

Vol. X.] February, 1884. [No. 2.

It was with great pleasure, that, in the New Year's *Gazette*, we noticed Mr. B. H. Baden-Powell's name amongst the list of newly appointed Companions of the Indian Empire. His connection with the Forest Department extended from 1869 to 1881, during which time, besides being engaged on special work regarding timber frauds to the extent of 3 or 4 lakhs of Rupees in Burmah, he was Conservator of Forests in the Punjab from 1869 to 1872, and from 1876 to 1879, and Officiating Inspector General of Forests to the Government of India during 1873-74. He was on special duty with the Government of India in 1879-81 to study revenue law and land-tenures, and to advise regarding the Madras and Burmah Forest Acts. He was associated with Dr. Schlich as joint Editor of the "Indian Forester" in 1875.

But his best known work has been the compilation of the very useful Manuals of Indian Land Revenue and of Forest Jurisprudence.

He is at present Additional Commissioner in the Punjab, where he lately officiated as Judge of the Chief Court, and we wish him every success during the remainder of his career in India.

SHORT NOTES ON THE NURSERY TREATMENT OF DEODAR AND OTHER TREES, AT RANIKHET.*

Deodar.—In this country deodar is best sown soon after the seed ripens, or early in December. The ground for seed beds should be light loam, or what is termed good garden soil. Heavy clay soil, which binds in wet, and cracks under the hot sun of April and May, should be avoided. The ground should not be manured, only carefully hoed, 15 inches or 18 inches deep, and levelled, and the seed sown in broad *shallow* drills 8 inches apart. Should the spring prove dry, the beds will require to be watered before the seed germinates, but this is not always

* The greater portion of these useful notes were written in 1875 and published officially. We reprint them, as they embody the results of long and mature experience.—[Ed]

necessary. When the seeds germinate and water is required, it is better to give a good copious watering once in two or three days than a little every evening, the good effects of which is quite nullified by the next day's sun. By July the young plants are sufficiently large to handle, and should then be transplanted in nursery lines 9 inches apart and 6 inches in the lines. This work is best performed by stretching a line and cutting along it a trench with a hoe or a spade, and against the smooth surface of the bank (which should be as perpendicular as possible) thus formed, the young plants are placed and supported by a handful of earth, care being taken to first fully extend their roots against the bank. The remainder of the earth being then replaced and levelled. This is much better than transplanting by dibble, the hole made by which is frequently too shallow, the roots are thereby curled up, and the plant makes no progress.

By next rains the plants must again be transplanted in lines 15 inches apart and 1 foot in the lines, care being taken to remove them with a little ball of earth adhering to their roots. The same care must be observed to fully extend their roots in the trench, and the ground should be pressed firmly about the roots to steady the plant. The plants soon establish themselves, and nothing further is required than to keep them free from weeds. By the following rains, the third year from sowing, the plants are ready for removal to the forests.

The seedlings sent over to Naini Tal (distance 30 miles) are taken up without any of the original earth adhering to the roots, and immediately packed in baskets, a little earth being placed round and among the roots to prevent drying up on the way. I send over plants of all ages, from 3 to 6 or 7 years' old, but the older seedlings have undergone frequent transplanting in the nursery. It is not safe to send old deodar far, if more than 18 months have elapsed since the last transplanting.

CHIL, (*Pinus excelsa.*)—The same treatment as for deodar applies to this tree in the nursery.

CHIR, (*Pinus longifolia.*)—The seed of this tree does not ripen until March or April according to situation. Sow then and transplant as directed for deodar.

BAN-OAK, (*Quercus incana.*)—Collect acorns early in December; gather from the tree, and not those that have fallen, which are generally worm-eaten. Any ordinary good soil, prepared as directed for deodar, will suffice for the oak. Sow like peas in broad drills a foot apart and 3 inches deep, keep free from weeds during the summer rains. During the *second* rains from sowing take up the young plants, lightly trim their roots, and transplant in lines 15 inches apart and 9 inches in the lines. Again weed and occasionally stir the surface of the soil, and during the following rains remove to the forest if the planting is near at hand; if very distant, again remove into nursery lines in

rather poor soil, and transplant in the forest next rains. Oak succeeds best when transplanted during the rainy season.

HORSE-CHESNUT, (*Æsculus indica.*)—Soon after the seed ripens, in November or December, sow in good rich soil in drills a foot apart, 3 or 4 inches deep, the seeds 6 inches apart. Keep free from weeds during the rains, and when the young trees shed their leaves in the cold weather take them up, lightly trim their roots and transplant in good soil, in lines 18 inches apart and 1 foot in the lines. Occasionally stir the surface of the soil during the hot weather. No watering is required; keep free from weeds. In the cold weather the plants are fit for removal to the forests. They should be taken up without any earth adhering to their roots, which, in the case of distant planting, is a convenience and saving.

WALNUT, (*Juglans regia.*)—The same treatment of sowing, pruning the roots and transplanting, as directed for the horse-chesnut, applies to the walnut. These trees, in fact all deciduous trees, are best transplanted during the cold weather.

ALDER, (*Alnus nepalensis.*)—This should be sown at the end of February or beginning of March in very shallow drills, a foot apart, on level ground. After sowing, the ground should be covered lightly with fern or grass and watered occasionally until the seed germinates, after which gradually remove the covering, and weed, water and stir the soil as directed for deodar. During the following cold weather take up the seedlings, trim their roots with a sharp knife and transplant in lines as directed for horse-chesnut and walnut. The plants, as in the case of horse-chesnut and walnuts, are fit to remove to the forest the second cold weather from time of sowing.

ACACIA.—Choose a good friable soil which, when dry, dig about 18 inches deep. If the land is not level, it should be formed into small terraces according to the lie of the ground, and across the terraces make beds 4 feet wide with 18 inch paths between. Sow in fine weather, early in February, in shallow drills across the beds and 8 inches apart. If the weather proves dry the beds must be well watered, as directed for deodar, and when the young plants appear they should be kept free from weeds and the soil between the drills frequently stirred with a small Dutch or draw-hoe. All watering, weeding and hoeing should be performed from the paths, and the beds not needlessly trod upon. By the middle of July, being then 6 inches to a foot high, the seedlings will be ready to transplant. Any ordinarily good ground, level or sloping, will do to transplant in, but care should be taken to avoid places subject to severe hoar frost. Take up the seedlings, line by line, with a digging fork, separate them into two sizes, and plant the largest in one plot in lines 15 inches apart and 1 foot in the lines; the smaller plants put on another plot in lines 1 foot apart and 9 inches in the lines, and afterwards keep free from weeds. By the follow-

ing rains the plants will be ready to remove to the forests or plantations.

EUCALYPTUS.—Sow as directed for Acacias.

About the middle of July take up the seedlings, separate them into two sizes, and plant as directed for Acacias, and, as in their case, also carefully avoid low damp places subject to severe hoar frost. Choose wet days for the work, and, when the plants are established and weeds appear, hand-weed the lines, or, if a few fine days occur, first lightly hoe between the lines. Never allow weeds to over-top the plants, or they will be drawn up, weakly and be unable to withstand the winter without protection. By the following rains the plants will be ready to remove to the plantations. If the plants are required for very exposed situations, instead of sowing the seeds in February, defer it till July, and then sow in sandy or gravelly soil, sloping gently to the east. Line off the beds across the slope, inclining a little one way for the paths to carry off heavy rain. The beds should not be level but sloping like the land, and raised a few inches, by means of the earth taken from the paths. Sow the seeds in very shallow drills across the beds, and when the young plants appear keep them free from weeds. About Christmas, or when snow is apprehended, cover the beds with grass tatties, raised 18 inches from the beds. This covering should remain until the middle of February, or later if the locality is very cold and exposed. If the spring is dry, well water the beds three times a week, or oftener if necessary, occasionally stirring the soil between the drills to prevent its caking; and, when the rains set in, take up the seedlings, separate them into sizes and plant as directed for spring-sown ones. Afterwards keep the plants free from weeds and remove to the plantations the following rains.

Unless the soil and situation are very favorable, the several kinds of gums should not be planted over 6,000 feet. Above this height they are liable to be broken by heavy snow lodging upon their tops and branches and weighing them to the ground. This year at Dúnágiri, at an elevation of 6,500 feet, two large blue gums, 10 years' old and over 60 feet high, were broken short above the ground by snow lodging upon them, younger plants of the same variety at a similar elevation at Ranikhet were also broken, while leafy plants of the same kind, 5 years' old, at an elevation under 6,000 feet, escaped, their leaves being smaller and not so dense. Acacias are not so easily broken, and may therefore be planted at a slightly higher elevation than that recommended for the Gum, but care should be taken in planting either tree to avoid damp dells or flats subject to severe hoar frost. Of Gums, the blue and iron bark (*Eucalyptus globulus* and *Sideroxylon*) are the best sorts to plant in the hills; and of Acacias, *decurrens* and *Melanoxylon*.

W. CRAW.

TO MAKE CHARCOAL.*

THE best sized wood for this purpose is of the form understood as billets. An ordinary kiln for smelting measures 18 feet in diameter, and requires about 25,000 billets, cut as nearly as possible of the same length. Procure a pole about 25 feet long and 6 to 8 inches thick, straight, and of uniform thickness. Provide yourself with four forked sticks of the shape of *Fig.* 1. Erect the pole perpendicularly on the spot where the kiln is to be made, and place the four forked sticks round it, arranging pieces of wood from fork to fork and across, to make a hollow space in the centre of the kiln, of about 18 square inches, as in *Fig.* 2, for containing combustible matter. Provide the person stacking the billets with a yard measure, and with one end of the measure against the pole, let him sit at the other end and place the billets in an almost perpendicular position against the cross pieces, and as close together as possible, each coolie stacking right and left to join his neighbour's work on either side. Thus he goes on stacking until he has come to the end of his measure; all having done the same, a perfect circle will be the result. After having filled up with brushwood or old charcoal all interstices there may be from crooked or large billets, each coolie pulls out his measure to another yard in length and proceeds as before. Having done this the third time, the kiln will measure 18 feet in diameter. The coolies then mount the first layer of billets and commence stacking from the pole, until they come to the end of the second layer, making an allowance for the curve, and so on a third and fourth layer, until the kiln is completed, as shown in *Fig.* 3. Cover in the whole kiln with turf, 3 to 5 inches thick, turning the grass side inwards, commencing from the bottom; after which throw a small quantity of loose earth over the turf, beating it down with the back of a spade; if turf is not procurable, put a compact layer of earth over leaves and brushwood, moistened with water.

After the whole kiln has been covered in, let one or two men ascend and pull out the pole, leaving an empty space from top to bottom. From the top, drop in a ladle full of ignited charcoal, and immediately this is done, open out one turf at the bottom of the kiln, say at A. This will cause a draught of air in the direction of ADC, *Fig.* 4, and in a few minutes, dense smoke will be seen ascending at C, and vapour condensing on the coating, after which flames will burst forth. Let this continue for five or ten minutes, till it is clear that the billets in the centre of the kiln are on fire, when a man must be sent up with a large turf to close the opening at C, over which he

* The above paper was found amongst the Dehra Dún office records, and has been reprinted here for the benefit of readers of the "Indian Forester;" it is not dated.—[ED.]

should sprinkle earth to keep in all flame, and secure uniform combustion in all parts of the kiln. *From this moment no flame must be allowed to escape from any part of the kiln.* When the opening at C has been closed, one at B should be made. The billets in the direction of DA and DB will then ignite faster than any other, and when smoke is seen escaping between every turf in the direction of AC and BC, the openings at A and B must be closed and fresh ones made, say at E and F; these will be closed in their turn and others made at G, H, I, and J, *Fig.* 5. Shortly after this, smoke will be seen to issue uniformly from every crevice, when all air holes at the bottom must be closed. After the charring is complete, the whole kiln will fall in at the end of two or three days, according to size, and assume something of the shape in *Fig.* 6.

Earth must then be thrown on with shovels to *extinguish all smoke*, and at the end of 36 hours, the charcoal may be raked out. A few buckets of water should be in readiness, if required to put out the sparks of fire which may remain.

Great care must be taken to stop every fissure in the casing, and if from bad management the heap settles, and the casing falls in at any part, the cavity must be filled up with green wood kept ready for the purpose, and the covering replaced. As soon as the dense smoke ceases, and the wood burns with a light transparent smoke, the whole must be closed in and watched, lest any fissures appear.

In burning in pits, vent-holes are made in the sides, and the covering of sods being of smaller extent, is easily formed, and the wood is more conveniently packed, as shown in *Fig.* 7; the logs in the middle of the lower course should be dry with a few chips and refuse charcoal from former kilns among them.

Sometimes, it may be convenient to form a kiln by digging out the side of a hill, (*Fig.* 8,) but in all cases the system is the same. If the process is properly conducted, the bulk of charred wood is not greatly reduced.

In climates where vegetation is rapid, it is not necessary to cut down trees for charcoal, but merely to lop off lower branches; refuse wood should be used in the manufacture, and dry wood is superior to wet, as it splits more easily and saves labor. On dry forest land, a crop of wood sufficient for charcoal can be obtained every fifth or sixth year, and on marshy land, every third year.

Some woods are better suited for the purpose than others. Hard woods, with a close grain, make the best charcoal; in England, oak, elm, beech, and ash, are generally used. The following abound in many parts of India, and amongst others have been found suitable for the manufacture :—

Sál, *Shorea robusta.*	Kheir, *Acacia Catechu.*
Sissú, *Dalbergia Sissoo.*	Teak, *Tectona grandis.*
Kikar, *Acacia arabica.*	Nim, *Azadirachta indica.*

TO MAKE CHARCOAL.

FIG. 1.

FIG. 2.

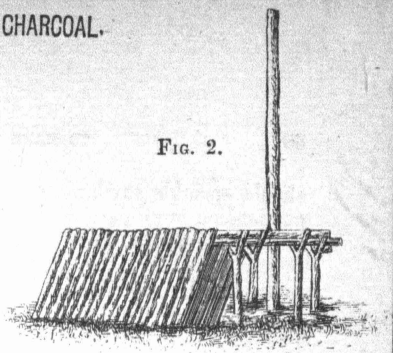
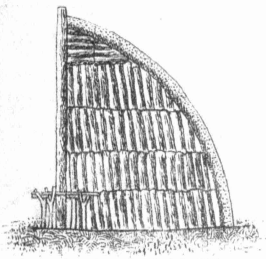
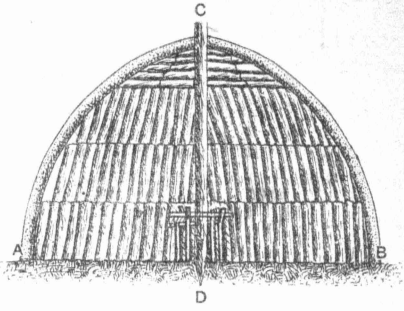


FIG. 3.



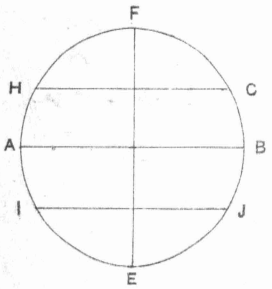
Section of one-half of the Kiln.

FIG. 4.



Vertical Section of Kiln.

FIG. 5.



Horizontal Section of Kiln.

FIG. 6.

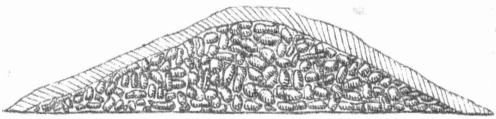


FIG. 8.

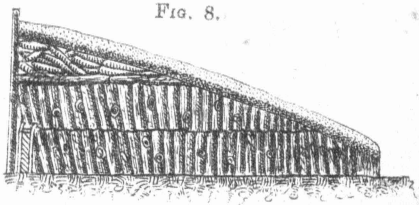
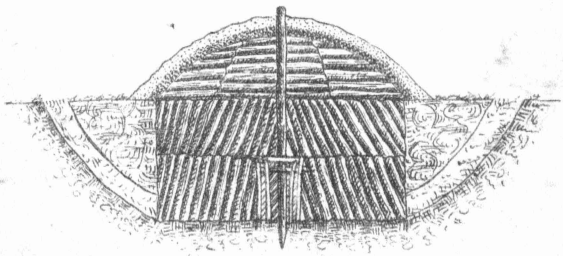


FIG. 7.



Section of a Charcoal Pit.

Litho. T. C. Press, Roorkee. THOS. D. BONA, *Supdt.*

Sandun, *Oojeinia dalbergioides.*	Box, *Buxus sempervirens.*
Lohira, *Tecoma undulata.*	Oak, *Quercus incana.*

Soft woods with an open grain and quick growth are not so well adapted for making furnace charcoal: white and resinous woods are seldom used. The comparative value of Indian hard woods in charcoal making is an interesting subject of inquiry, and careful experiments to determine the best sorts of timber for special purposes are required: the proportionate produce from 1000 parts of several kinds is given by Brande, as follows:—

Ebony, ...	... 300	Box, ...	... 202
Satin wood, ...	... 207	Fir, ...	... 181

The Beypore Iron Company, I believe, find the loppings and thinnings of the teak plantations in Malabar specially adapted for smelting purposes, and in a short time the prunings of sissú, &c., in the canal plantations of the Punjab and North-West Provinces may be equally valuable. The utilising of thinnings and of refuse timber is urged upon all Forest officers.

The economic preparation of charcoal at the different hill stations is most important, and the best mode of initiating it, is to collect the charcoal burners and to give them practical instruction by firing a small kiln in their presence. The outturn of slow charring is so much larger than that obtained by their rude process in open pits, that they will generally be found to adopt the principle of a closed kiln. In several experiments in the Himalaya, where the common Ban oak (*Quercus incana*) was used, one-third more in bulk was obtained than by the common method, and the charcoal was in larger pieces, heavier, and well charred. Wicker baskets, being elastic, do not break the charcoal and are generally used for transport.

H. CLEGHORN,
late Conservator of Forests.

INTERNATIONAL FORESTRY EXHIBITION, *Edinburgh, 1884.*

WE give below the list of subjects for prize essays at the Edinburgh Forestry Exhibition, and hope, for the honor of the Indian Forest Department, that some of our readers will compete.

ESSAYS AND REPORTS.

Concise Practical Essays on the subjects enumerated below would be much appreciated, and would assist the labours of the Jurors and Reporters.

Systematic Collections of Forest Produce, specially illustrating the sources of Supply and the methods of Manufacture in different Provinces, with accompanying Reports, are solicited.

Any such Reports or Collections must be forwarded direct to me on or before 14th June, 1884, and they will be immediately acknowledged and referred to the several Sections.

Diplomas, Medals, and Money Prizes will be awarded on the recommendation of competent Jurors.

1. On the Formation and Management of Forest Nurseries.
2. On the Formation and Management of Plantations in various Sites, Altitudes, and Exposures.
3. On the Present and Prospective Sources of the Timber Supplies of Great Britain, with Statistics of the various descriptions of Timber Imported during the past 25 years.
4. Report, with Specimens, of any Hard Wood likely to supply the place of Box Wood for Wood-engraving.
5. On the Afforesting of Mountains and other Waste Lands, with details of the method adopted and the results obtained. To be accompanied with Drawings, Photographs, or Models.
6. On the effects of Forests on Humidity of Soil and Climate, from personal observations made by the Author in any Country or Locality.
7. On the Treatment of Coppice and the Utilisation of Branches and Fragments of Forest Produce, with the view of diminishing waste.
8. On the Growth and Management of Eucalyptus Plantations, and their economic uses.
9. On the best Method of preventing Erosion of River Banks, with Illustrations.
10. On the comparative advantages of the various Methods of producing and harvesting Cinchona Bark, with Specimens.
11. On the ravages of Tree and Timber destroying Insects, with Specimens and Illustrations.
12. On the ravages of Mollusks and other Marine Timber destroying Animals (excluding Insects).
13. On the Destructive Influence on Wood of Fungi and other Plants.
14. On the Supply of Teak Wood for Ship-building purposes.
15. On the Utilisation of Forest Produce in the manufacture of Paper.

The Executive Committee are anxious to obtain Reports on the Forest Productions of our own Crown Colonies or Foreign Countries, accompanied by Specimens.

GEORGE CADELL, *Secretary*,
3 George IV. Bridge, Edinburgh,
(*Late Indian Forest Department*).

ASH COMPOSITION OF SOME INDIAN WOODS.

TO THE EDITOR "INDIAN FORESTER."

THE following statement gives the composition of the ashes of six Indian woods, which have been analysed in 1883 by students in the Central Forest School Laboratory.

Chemical analysis of the ashes of woods, 1883. 100 parts of steam dry clean wood without bark contain—	*Ægle Marmelos*, or Bél. Kedar Nath Mozamdar and Mahadeo Rao, Students.	*Schleichera trijuga*, or Kosum. Roghunath Pathak and Golám Mahomed, Students.	*Acacia arabica*, or Babul. Sadhú Singh and Ram Anand, Students.	*Diospyros melanoxylon*, or Tendu. Jogeswar Sur, Student.	*Ficus religiosa*, or Pipal. Charles Ingram, Student.	*Cupressus torulosa*, or Devi Diar. Messrs. Copeland and Blanchfield
Soluble potassium and sodium compounds, ...	0·16	0·08	0·04	0·13	0·15	0·004
Phosphates of iron, calcium &c., ...	0·13	0·18	0·04	0·11	2·25	0·039
Calcium carbonate, ...	2·16	1·01	0·69	1·79	1·96	0·044
Magnesium carbonate, ...	0 19	0·17	0·06	0·29	1·07	0·008
Silica with sand and other impurities, ...	0·01	0·02	0·01	0·02	0·05	0·004
Total ash, ...	2·66	1·46	0 84	2·34	5·48	0·099
100 lbs. of air dry wood weigh steam dry lbs., ...	89·6	86·4	80·0	89·6	90 6	90·8
Sodium compounds estimated in the soluble salts, per cent., ...	7	15	25	0	1	5

Ficus religiosa shows the largest and *Cupressus torulosa* the smallest amount of ash. The wood of *Cupressus torulosa* may almost be considered free of mineral matter. For making one maund of potash out of pure cypress wood, no less than 25,000 maunds of the wood are required. The analysis of other woods was communicated in the "Indian Forester" in December 1882.

It has also been stated that an experiment made with 250 maunds of sál wood, bark and branches, resulted in three seers of crude potash. It would take 2,700 maunds of the sál wood, bark and branches, to produce one maund of crude potash. The potash was further found to contain—

Potassium carbonate, ...	84	per cent.
Potassium chloride, ...	3	„ „
Potassium sulphate, ...	13	„ „
Total, ...	100	

The above salts include, by estimation, about $\frac{1}{20}$th of the whole in sodium compounds.

The potash was made by lixiviation, in such a manner that probably three-fourths of the soluble salts were realized.

26th December, 1883. H. WARTH.

TO THE EDITOR, "INDIAN FORESTER."

CAN you inform me when the International Forestry Exhibition will open at Edinburgh?

Has any scheme been mooted to enable Forest Officers to go home to see it? Many who are interested in their profession would doubtless like to avail themselves of such permission. If any scheme has been proposed, I should like to know particulars.

KAT BANS.

We have not heard as yet whether the date of inauguration of the Forestry Exhibition is fixed or not. In fact in the last Journal of *Forestry* we read that there is a difficulty about the site. No scheme for enabling Indian Forest Officers to visit the exhibition has yet been mooted.—[ED.]

JJ. Reviews.

Mr. VINCENT'S REPORT ON FORESTS OF CEYLON.

(Continued from January No.)

We have given copious extracts from the first part of Mr. Vincent's report, as we wished to place the past history of Ceylon forest management clearly before our readers. It is evident that want of systematic management, and the fact that merit has been judged by the amount of net revenue made, without any enquiry into the cost, as well as the absence of any proper land revenue system in Ceylon, are the principal causes of part failure.

The first crying want is a Forest Act, the present Timber Ordinances, according to Mr. Vincent, being practically worthless, the law being so ineffective that in many cases a civil action for damages is preferred to a criminal one.

Mr. Vincent has proposed that the Burmah Forest Act be adopted, presumably with some modifications to suit the altered circumstances. In support of this proposal we quote as follows :—

"We have in India three Forest Acts—the Indian Act (VII. of 1878), applicable to Bengal and Bombay; the Burmah Act (XIX. of 1881), current in British Burmah; and the Madras Act, lately passed by the Madras Legislative Council, and about to be confirmed by the Government of India. Of these, I would recommend, as being that most suited to Ceylon, the Burmah Forest Act. It is the one with the most simple procedure and the one nearest approaching the principle of the present Timber Ordinance, and with some alterations will be found workable here. Both the Indian and the Madras Forests Acts, although agreeing in principle with the Burmah Act, contain several features which would be unnecessary.

"The circumstances of Ceylon and Burmah are similar in many respects: in both countries the State is the owner of all waste lands, and in both cheena or toungya constitutes the chief enemy of the forest. In Burmah, as in Ceylon, there is superabundance of forest, but not of the right kind, cultivation and the unrestrained exercise of rights causing the good natural forest to be replaced only by worthless trees."

Regarding the constitution of the forest area, the first step is evidently to get forest reserves selected, demarcated and surveyed, and we may here mention that the fact of the large reserve above the 5,000 feet line of 90,000 acres having been strictly conserved, is due to Sir Joseph Hooker's representations,

and that land is rarely taken up for coffee above 4,500 feet, and that cinchona cultivation only commenced after the rule was sanctioned by the Secretary of State that no land above the 5,000 feet line should be sold. Mr. Vincent now proposes that no more crown land be sold until the forest reserves have been selected, and that in future no sales of crown land *except for cultivation* should be permitted.

These measures are clearly the very basis of any scheme of forest conservancy for Ceylon. Regarding the necessity for an efficient professional Forest Staff, as well as the plan for future management, we will quote Mr. Vincent's words :—

"In whatever way we look at the present arrangements, a radical change appears advisable. Matters of secondary importance—the working out and selling of timber—have occupied the entire attention of the Foresters, and have proved, commercially, a failure, whatever results figures may show—although here we may almost question whether the old license system would have not given equally good results—whilst the primary importance of forest organization and improvement has been entirely neglected. Notwithstanding the fact that the general failure in the natural reproductive process has always been noticed by every unprofessional observer, we have entirely concerned ourselves with the sale of forest produce, using our best endeavours to clear out the latter as rapidly as possible without the least thought for the future. Under a departmental system, these matters could not have met with greater neglect, and under it we might, in addition, have had the working out of forest products by Government agency developed into a workable system, instead of merely having replaced the old license system by arrangements remarkable only for their want of method, and for a disregard of the most ordinary common-sense precautions.

"Considering everything, it is perhaps remarkable that the past results have not been more unfavourable. The entire forest work was entrusted to young officers, who had to fill a most difficult position. They had no experience of forest work, and with only temporary tenure of office the vast forest properties were handed over into their charge; they were told to make revenue, with the general understanding that the permanency of their employ or their promotion would depend on financial results. Until now no enquiry has been made as to how these results have been attained.

"The plan that recommends itself for adoption in the future is that—

(*a*). The provincial system, by which the Forester and all forest operations in each Province are placed under the entire control of the Government Agent, should be retained in principle, although slightly altered in detail.

(*b*). That the appointment of a skilled forest officer be made to advise Government and the provincial authorities in matters of forest management, and to supervise the whole of the forest work in the Colony.

"This officer should be attached to the Colonial Government, and whilst his duties would consist in forest organization and controlling the whole of the work in the Island, he would direct a branch of the

Colonial Secretary's office, and not act as if he was at the head of a distinct department."

In fact we have the same scheme for control of the work as that in force in the N.-W. Provinces of India, though the Government agent in Ceylon will perhaps have more time and inclination to give direct orders to his District Forest Officer than is usually the case with us.

The next step is the familiar annual plan of operations and the budget. Regarding the appointment of Forest Officers, we again quote from Mr. Vincent's report :—

"I should suggest that in future a graded Forest Department be formed, in which a fair and progressive scale of salaries, with the usual privileges regarding leave and pension, would be offered to attract good men of some qualifications, who will make the Forest Service their profession. All the provincial foresters would be on one list, and the promotions would go by merit and by seniority.

"In the selection of officers, it may be allowed me to draw attention to the points which most should be thought of. These are a knowledge of forestry and botany, and of surveying, and a good colloquial knowledge of Sinhalese and Tamil. The first two would probably not be always obtainable, but a good colloquial knowledge of the languages and of elementary surveying is essential. The Forest Officer must not, as is too often the case now, be entirely dependent on his English-speaking overseer or servant, but he must be able to communicate readily with the natives with whom he will have to deal if his duties are to be carried out efficiently. Indeed, the first conditions of finding permanent employ in the Forest Service ought to be a thorough knowledge of both the vernaculars.

"The appointments in the superior staff will naturally be made by Government, but in the posting of the officers and in the general organization of the staff the opinion of the Conservator will no doubt be taken, when to a great extent he will be responsible for the organization of the provincial staff and the manner in which the work is carried out.

"In concluding this subject, I would venture to point out the extreme importance of providing some technical education for the officers employed. The salaries which the Colonial Government may offer would perhaps not be sufficient to attract men from home who have gone through a long course of forestry, nor is it certain that in any case they would prove a success in so small a service. There are a large number of good men to be found in the Island, with a good colloquial knowledge of the languages, who would make the best of forest officers if they could once see how forest work on a large scale is conducted, and were given means for acquiring the rudiments of the science.

"To make good practical foresters, it is not necessary that a long course of study should be gone through, but at first, until the forest system is thoroughly developed, it is most necessary that the officers selected should have opportunities for seeing how forest work, when carried out on a large scale, is brought to a successful conclusion outside the Colony.

"They must have the means for acquiring elementary, theoretical, and practical knowledge, and when they have seen how the former is applied elsewhere, it will be easy to apply it to the local requirements of Ceylon.

"With this view, it appears most advisable that after serving a term of three to six months' probation in the Ceylon forest, the men selected by Government for employment, and also some of the more promising of the junior officers, should be sent to the Forest School at Dehra Doon. The means are offered for acquiring theory combined with practice, and it could no doubt be arranged with the Government of India that those portions of Indian forest work which most resemble the circumstances of Ceylon should form the subject of a short course in connection with the Forest School. This arrangement would—for Ceylon—probably be more suitable than if high salaries were offered for men at home, who would come out ignorant of the languages and unaccustomed to the rough jungle life and the application of English theory and system to the requirements of the East. In India, such a man would be trained for sometime under an experienced officer. In Ceylon, he would be placed at once in a most responsible position.

"Nothing could be of greater influence than this in the proper development of the Ceylon forest system, and I trust that it may be found feasible. The time spent in India should form part of the period of probation, and no appointments should be given to those whose attention to their work, or whose progress had not satisfied the Indian authorities. During the term of probation the candidates should be allowed a small salary and travelling expenses, but in any case this would not amount to more than Rs. 2,000 for the first year of probation. This is no large sum to pay for an officer accustomed to the country and the people, and fit to be entrusted with responsible forest work one year from his first appointment. The selection of suitable men will of course form a most important point, but by offering the same salaries as at present, with the certainty of position and a gradual rise in pay, the selection of a valuable staff will occasion no difficulty if the tests which I have mentioned are enforced."

We will conclude our remarks here with the hope that the Colonial authorities will accept the principle of Mr. Vincent's recommendations, and not suffer the future welfare of the island to be jeopardized by a continuance of the present disgraceful state of mismanagement of its forest resources.

We read in the *Pioneer* that the German Post Office Inspector, Mr. Otto Pankow, now engaged in taking notes of the working of the Post Office system in India, considers Ceylon as a century behind the civilized universe, and Mr. Vincent's investigations fully substantiate this.

THE MADRAS FISHERIES BILL 1883.

In France the inland fisheries are under the control of the Forest Department. We have not attained that stage in India,

and except so far as rules can be made for regulating fishing in rivers and other waters within the limits of reserved forests, Forest Officers are but little concerned with river and lake fisheries. There is, however, a sufficient connection between the Forest Officer's work and fishery-protection, to make it at least excusable to notice the really useful, though not very well drafted, Bill which appears in the *Fort St. George Gazette* (December 21st, 1883).

The Bill itself is a modest one in 73 sections, but it is preluded by a "Statement of Objects and Reasons," which is so brief as to be almost useless, and by a second statement of most portentous length. No less than 154 long paragraphs (some of them occupy nearly a page each) are devoted to the anxious explanation of everything. The writer seemed to be oppressed with the fear that either his readers could not understand the simplest matters, or that they would dispute the most obvious propositions. Therefore like SIR MACKLIN—

> "In lavish streams his accents flow,
> Tom, Bob and Billy dare not flout him,
> He argued high; he argued low,
> He argued also round about him."

The first 25 paragraphs explain how very important fish is as a 'nitrogenous,' while wheat is a 'farinaceous,' food; and what a lot of fish the London people eat every day; and how important are the figures which indicate the dimensions of the fishing business in salmon, sardines and mussels. The writer next examines the English Law and the Burma Fisheries Act, and seems to think it a matter requiring nice and careful vindication that the Madras Law should differ (as the Burma Fisheries Act does) from the English Law. But the wonder is not that there should be difference, but that any use can be made at all of English Acts, since the facts are wholly different in the two countries! In Burma most fishery rights belong to the State, in England they are nearly all private property. Perhaps the Madras Council are not easily persuaded that English Acts are far from being types of perfection, or that legislation must be based upon and accord with *facts*.

One of the immediate causes of legislation in Madras, would appear to be that no one can at present be punished for stealing fish.

The cases quoted are certainly rather remarkable. A Magistrate convicted a person under section 379 of the Indian Penal Code for "theft," for stealing fish out of a large irrigation tank which belonged to Government, and was leased. Of course (as every Forest Ranger who has gone through the law class knows) the essence of *theft, under section* 379, is that the property stolen should be at the time *in the possession* of the owner. Now fish swimming at will in a large tank are hardly *in possession* of an owner. The High Court quashed

the conviction, limiting their order however to this *one* point; other attempts to bring the act under the trespass sections, &c., obviously failed. It is curious to observe that the authorities tried *everything but* the one section which we should suppose applicable, viz., section 403, which punishes an act closely resembling "theft," *except* that in "criminal misappropriation" the property taken need not be actually *in possession*. Unless it is held that fish preserved in a tank (and subject to lease of the right to catch them) are *not property at all*, section 403 would apply. There is indeed some sort of indication in an extract from a letter of the then Advocate General that fish are not property, but the language (especially without the context) is too obscure to lead to such a conclusion. However by all means such a point should not be left in doubt.

Readers of the "Fuller Statement" will also be glad to hear that the Madras Bill has *a soul* as well as a body; and he will also meet with some long sentences which will tax his powers of parsing not a little. He will also find some phrases, that make him think the writer has taken as his model, that delightful little book "*English as she is spoke*." But when all is said, the Minute, long as it is and badly written, is nevertheless full of really valuable information and sound reasoning: and the Bill itself (indifferently drafted as all Madras Acts are) shows at least a thorough grasp of the subject, and contains, though at present in a *very* rough shape, materials for a good law.

Inland fisheries are protected thoroughly, and the Coast fisheries are not forgotten: the vile practice of poisoning water with *nux vomica* and other drugs will be suppressed, and the erection of all sorts of "engines," weirs, and the like, controlled: the destruction of young fish can be prevented by the use of gratings, and the size of mesh in nets may also be regulated. There will also be an end to the days when poachers can fish in duly owned and leased waters with impunity.

In England, private owners of fisheries are made to take out licenses, the fees from which form a fund, out of which the Boards of Conservators and Inspectors, &c., &c., are paid. The license-holders then lease their rights to persons who have leave, lease, or license, under them. This plan will be adopted in Madras, in cases (apparently only occasional) where the Government is not owner of the fishery. But there is no doubt whatever, that in Madras as elsewhere, the fisheries have been State rights ever since the days of *Akbar* at any rate; and the same as the case may add with the old Hindu Rajas. The "jalkar" was a recognised source of income, whether it came into the hands of the Zemindar or Jagirdar, or belonged to the State. Naturally enough when Government originally gave up its rights to zemindars or other grantees, it gave up such

fishery rights as were in the territory granted. But in every case it ought to be shown either that the fishery is clearly within the estate and was presumably granted along with it, or that some express and long continued user has extinguished the Government claim.

In Bengal and other provinces, it is certainly in this way that certain fisheries and "jalkar" profits have come to be recognized as belonging to the zemindars, &c., so it is rather curious to find Mr. Thomas nervously feeling his way to legislate, for fear of those "sacred" rights (*see* paras. 41, 42), and then opening his Bill with the bold preamble "Whereas the exclusive right of the fishing in the Madras Presidency in all fisheries and hereinafter excepted belongs * * * to Government." It is perfectly right to do so, but why make any difficulty about it? How the question admits of any doubt is more than we can understand. Section 43 makes full provision (in the curious language of Madras Acts) that "nothing * * shall *prejudice* or derogate from an *express grant*, &c."

The details of the Act itself we have not space to examine (nor would the scope of this Journal admit of our doing so). We will only add that the arrangement of the various sections appears to need a very great deal of consideration; questions of right, and of power to impose license fees on private fishery owners, and the powers of controlling fisheries generally, would appear, in their natural order, to come before details as to the constitution of Boards, the use of a common seal, and the reduction to writing of contracts over Rs. 20 in value.

The phraseology is also everywhere defective: on a very cursory glance through the sections, we noticed such phrases as the following:—"prejudicing a grant," "taking means to preserve" things, a "Commissioner of fisheries may order a *grating to be placed*" (at such a point) "*out of* fishery funds," he also "may adopt such means as he shall approve": rules may be made for "aiding fishermen by instruction, example *and loans*," "property theretofore vested," "put up a notice in any part of a fishery" (—by definition a fishery is a *collection of water* * * * * in *which fish may be found:* it includes the sea). Such mistakes, and these are not the worst, could be quoted by the score. It is not creditable to allow a Bill to go before the public in such a slovenly and inaccurate form.

THE JOURNAL OF FORESTRY.

August.—The following quotation from Mr. Little's paper on the destruction of American forests shows the alarming destructive power of the American axe:—

"The entire supply of white pine growing in the United

States and ready for the axe, does not to-day greatly, if at all, exceed 80,000,000,000 cubic feet, and this estimate includes the small and inferior trees, which a few years ago would not have been considered worth counting. The annual production of this lumber is not far from 10,000,000,000 feet, and the demand is constantly and rapidly increasing. The publication of these facts a few months ago has greatly increased, and in some cases more than doubled, the value of pine-lands, and it does not require any particular powers of foresight to be able to predict that the price must advance to still higher figures. Enough is now known to permit the positive statement that no great unexplored body of this pine remains, and that with the exception of the narrow red-wood belt of the California Coast, no North American forest can yield in quantity any substitute for it. Canada appears to be better off than her neighbour, but reckless felling is there also the order of the day. There is still timber in her great forests spread over 100,000 square miles in the territory watered by the Ottawa, the St. Maurice, and the Saguenay, besides two forests which have been as yet but little worked, namely, in British Columbia in the West, and in the interior of Newfoundland in the East. Let us hope that these latter forests will not be made over to the Goth-like ravages of the lumberman, but that Canada will form them into State forests, and manage them systematically for the benefit of the community at large, constituting them estates of permanent value instead of treating them like coal-mines."

In the same Number there is an interesting account of a "Forest Ramble through Madeira." The name of the island is derived from the Portuguese word for timber.

There is also a letter from Viscount Powerscourt about the re-afforesting of Ireland, from which it appears that *Pinus Laricio* succeeds very well at Powerscourt, growing much faster than Scotch Fir, and yielding good timber. The cost of planting per acre is estimated at £4 13*s*. 11*d*., and the value of a plantation 45 years' of age at £50 per acre.

September.—The most interesting item for Indian Foresters is the speech of Sir J. Lubbock in the House of Commons on the 2nd of August concerning the establishment of a Forest School in England, which we quote in extenso :—

"So much, indeed, had forestry been neglected, that in Scotland the words suggested deer, but no trees; while the idea of foresters in England was associated with the members of an excellent provident institution. Of course, the Crown forests formed but a small part of the subject. There were altogether, in round numbers, 2,500,000 acres of woods and plantations in this country, so that the subject was one of vast importance. Moreover, it was calculated that in Scotland and Wales there were 5,000,000 or 6,000,000 acres at present almost valueless, and which, if judiciously planted, would give large results. In the science of forestry we were, he feared, far

behind most foreign countries, especially France and Germany: and he was very anxious that our landed proprietors should benefit by the experience which other nations had acquired. But let him ask where was a country gentleman who owned woodlands to obtain information as to their management or to procure trained assistants? We had no Forest School in this country; we had no class of persons specially trained and instructed in the formation and management of woods. It was, he feared, still true that, as the House of Commons' Committee of 1854 reported, timber is 'everywhere worse managed than any other species of property.' Unless something were done this state of things would continue. On the other hand, the highest authorities had expressed a very strong opinion that we might make our woodlands much more profitable; they showed one step which was a necessary preliminary. The highest English authorities were strongly in favour of the establishment of a Forest School, and had forcibly pointed ont the loss which our present system of management, or rather mismanagement, entailed on landowners. Mr. Brown, in his standard work on forests, observed that 'if our forests had been judiciously managed we should not find so great a part of the woodlands of Great Britain in the unprofitable state in which they are.'

* * *

"'We were the only important nation in Europe,' argued Sir John Lubbock, without a Forest School, and yet, if we included our Colonies, our forests were the largest and most valuable in the world. It appeared to be a very strong argument in favour of the establishment of a Forest School in this country, that at present the young men who were going out to manage our Indian forests had to be sent for instructions to the great French Forest School at Nancy. No doubt that was a most excellent institution, and we were indebted to the French Government for the courtesy with which they had received our English students; but the system of education given there naturally contained some branches, as, for instance, the study of French law, that were not adapted to English students, while there were many other considerations, such as climate, which rendered a Continental school less suitable for English requirements. He might add, he said, 'that no young Englishmen, as a matter of fact, went there excepting those intended for the Indian service. For our Colonies, again, the establishment of a good Forest School here would be of very great importance. A judicious management of their woods would add considerably to their income. French foresters had recently been sent to the Cape of Good Hope and Cyprus. it having been found impossible to obtain any countrymen of our own with the necessary knowledge. Perhaps, however, he should be asked why the establishment of such a Forest School, if it were so urgently needed, should not be left to private enterprise. The reason was clear. A properly equipped Forest School must have attached to it a large extent of forest in various stages, and having a variety of climates and soils. This, it was obvious, no private institution could supply. He did not, however, say that this would necessarily involve the establishment of a Government school. He understood that the Government contemplated an arrangement with the Cooper's Hill College, but he trusted that before instituting a Government school

they would enquire whether such colleges as Cirencester could be made available for the purpose, and possibly some arrangements might be devised by which, under careful regulations, the professors and students attached might periodically visit our national forests. He might mention, in illustration, that lately the Cape of Good Hope Government determined to appoint a Forest Commissioner, with an income of £800 a year. They could not, however, find any qualified Englishman, and were obliged to appoint a French gentleman, even though he could not speak English. The Society of Arts had memorialised Her Majesty's Government on the subject, and the presence in this country of Dr. Brandis and Colonel Pearson rendered the moment one of which it was desirable to take advantage. He hoped, therefore, Her Majesty's Government would not think him unreasonable if he asked them to consider this important question."

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"Mr. Courtney, the Secretary of the Treasury, whilst acknowledging the value of the suggestions put forward by Sir John Lubbock, said that the Treasury had not seen their way to do anything in the matter, but promised that the subject should not be lost sight of. This is not very much comfort for those who think that the question ought by this time to have passed the stage of 'consideration,' but it is better than none at all, and Sir John Lubbock, who will, we trust, persevere with his excellent movement, deserves the thanks of the public for what he has so far done in the matter. We shall be glad if he will favour us, in an early issue, with his views on the subject, and we can promise him more space for their discussion than that afforded him by *The Times*."

October.—In this number we have a short history of timber found in Irish bogs, and some sensible advice about road-making.

ANNUAL REPORT ON BOTANIC GARDENS AND PARKS IN NILGIRIS.

We have received through the kindness of the Inspector General of Forests, a copy of the Annual Report of the Nilgiri Botanic Gardens and Parks for 1882-83. Besides many matters of more or less local interest, a general failure of potatoes in the hills round about Ootacamund is noted, and is attributed to the high winds and heavy rainfall which prevailed last year.

There has been a similar failure in potatoes grown in the Jaunsar and Tiri hills near Mussoorie this year, but the cause cannot be the same, the rainfall having been below the average.

A number of fodder plants have been experimented on, and *Teosinte* and *Prickly comfrey* are specially recommended for the Nilgiris, the former being said to yield 10 lbs. of green fodder per plant.

Considerable progress is being made in the hills on cinchona

and in jalap cultivation, and 43,750 seedlings of the former have been obtained from seed of *C. calisaya*, imported from South America. Of the latter 18,000 tubers have been distributed since 1877.

The black Wattle, *Acacia decurrens*, is being planted out on the hills, in consequence of a report by Mr. Jamieson, the Superintendent of the Gardens, which appeared in the local papers, but we are left in darkness as to its special qualities.

The Superintendent made an interesting botanical tour in December and January last, and secured many interesting plants, chiefly orchids and ferns.

The Ceára rubber appears to thrive well, and six plants put out in January 1882, in one year have attained an average height of 11 feet, nearly all this growth being made between July and October.

RESULTS OF CHEMICAL ANALYSIS IN BURMAH.

THE British Burma Gazette, 24th November, 1883, contains a report by Dr. Romanis, on work performed in his chemical laboratory. We extract the following :—

Some plants used by the natives in Burma for *poisoning fish.*

Kyipin.—This appears to be the bark of *Barringtonia speciosa.* The active principle seems to be a volatile oil, which is combined with a resin in the bark. When freshly prepared the extract and the resin have a somewhat aromatic smell, which causes severe headaches.

The substance that causes the smell gradually disappears on evaporation of the alcoholic solution, and the residual resin has no effect on fish. The drug is said not to be poisonous, but simply narcotic, the fish recovering from its effects. There is no alkaloid present, but a notable quantity of tannin.

Bônlôn fruit.—This seems to be the fruit of a species of Euphorbia. It kills the fish instead of stupefying them as the former does.

Dye-wood.—A sample of a red dye-wood appears to be the root of *Butea superba*, a well-known creeper whose scarlet blossoms are a conspicuous feature of the forest landscape in February and March.

Rubber (Talaing nowthi).—A sample of India-rubber from Mergui, said to be from a creeper called by the natives Talaing nowthi. Leaves of the plant received from Mergui appeared to agree with *Tarameria glandulifera.* The rubber contained 23 per cent. of moisture, and 0·5 per cent. of ash, and was found equal to the best Para rubber.

Kyaikpoung.—A specimen of rubber not so good as the former, from the creeper *Chavanesia* (Urceola) *esculenta*, which has often been suggested as a source of rubber. This creeper

appears to be more widely diffused throughout the province than the other.

The native method of extracting the rubber by cutting down the tree and boiling the bark is extremely wasteful. The hot water coagulates the sap within the vessels of the plant, so that most of the rubber is retained in the bark and thrown away.

Tanning materials.—The eng bark was examined as to its tanning properties. It was found to contain too little leather-forming tannin to be of value.

Soils.—Dr. Romanis makes the following statements about soils. The general belief in the exceptional richness of the soil of Burma seems not supported by the results of analysis. There is much virgin land in the province, which is constantly being brought under cultivation, while exhausted soil is abandoned.

The fertility of the soils in Burma is proportional to the phosphoric acid in them. It is rarely that we find more than 0·1 per cent. of this substance in the best of the soils analysed, while a good soil in England contains over 0·2 per cent. The soil at the experimental farm at Alôn contains at the surface 0·09 per cent., and below the stratum disturbed by the plough 0·05.

Experiments with tobacco plants have shown that the principal constituent of the stem and of the midrib of the leaf is potash, that of the blade lime. As the leaf ripens the lime decreases and the potash increases in every part of the plant. The soil in which experiments were made with tobacco crops contained, soluble in hydrochloric acid—

Potash, ...	... 0·105
Soda, ...	... 0·180
Lime, ...	... 0·055
Magnesia, ...	... 0·065
Phosphoric acid, ...	... 0·050

Potash is present in fair quantity, while lime and magnesia are far below the average. Tobacco cannot be profitably grown in Pegu, because the soil is deficient in lime.

Sugar-cane.—Manganese was found a notable constituent of the ash of sugar-cane, apparently localised in the midribs. Whether essential or accidental is not yet decided.

23rd December, 1883. H. WARTH.

III. Official Papers.

EXPERIMENTS WITH DIVI-DIVI IN SIKHIM AND THE WESTERN DUARS.*

In the Kurseong Division about 100 seeds collected by Mr. Gamble in Orissa, in May 1881, were sown at Bamunpokri. Eleven seedlings came up, of which only four are now living.

On the 27th May, 1883, two tolahs of seed obtained by Mr. Manson, late Divisional Officer, from the Sonthal Pergunnahs, were sown in a small nursery in the Bamunpokri plantation in front of the Forester's house; the seed germinated freely, and the young plants are healthy and are doing well.

In June last a small bottle of selected seeds (about 1,000), received from a Mr. Cardozo of Madras, was sent to the Kurseong Divisional Officer from this office. These were also sown in a nursery near the Forester's house at Bamunpokri, on well-drained land, on the 7th July, 1883, and about 75 per cent. have germinated. The seedlings are reported to be doing very well, being about 4 to 8 inches high, and they appear to be healthy.

Two-and-a-half pounds of seed received from the Royal Botanic Gardens, Calcutta, were sown, 1½ lbs. on high ground near the rest house at Bamunpokri, and the balance on low but well drained ground, near the Ranger's house at Sukna. The nursery near the rest house at Bamunpokri was not completed till the 2nd August, 1883, as the seed being sown 7″ × 7″ it required the preparation of a large area. About 40 per cent. of the seed sown in this nursery has germinated, while the result at Sukna is remarkably good, the plants varying from 4 to 15 inches in height, and from countings made on the 15th September, 1883, it appears that nearly 75 per cent. of the seed germinated.

It is too early yet to be able to give a decided opinion on the seedlings that have come up, but their condition will be recorded in the plantation journal on every visit by the Divisional Officer.

In the Buxa Division three experiments have been made, two with seed received from the Conservator of Forests, Madras, and

* From a Report by Conservator of Forests, Bengal, dated 1st October, 1883.

one with that from the Royal Botanic Gardens, Calcutta. All appear to have succeeded very well.

Of the Madras seed (2 oz.), half was sown in nurseries on high well-drained land, and half in low swampy ground in compartment 21 of the Rajabhatkhawa block on 30th March, 1883, in beds 20′ × 10′, laid out in lines one foot apart, the seed being put down at intervals of 6 inches on the lines. The seed germinated thickly, the greater number of seedlings being found in the lower beds, where the growth is also most uniform, but the tallest plants are in the high ground, many being nearly 5 feet in height. There are now 919 seedlings in the two beds, viz :—

350 in high ground,
569 in low „

and they are looking very healthy and growing fast.

The seed from the Royal Botanic Gardens was received on the 6th June, 1883, and sown in the higher plantation in compartment 21, in the same manner as that received from Madras, but closer together, the result has been equally satisfactory. The seed germinated thickly, and the young plants are about a foot in height.

The result of the sowings of Divi-Divi in the Buxa Division may so far be considered successful, but it remains to be seen how the plants will stand the frost in winter, and the hot sun in summer.

REPORT OF EXAMINATION OF INDIA RUBBER FROM THE *CRYPTOSTEGIA GRANDIFLORA*, FROM KARACHI.

The sample herein referred to was enclosed in a cloth wrapper. The weight of rubber when received was 3 lbs. 5½ oz. nett. Some portions of it had become very sticky and much blackened by oxidation; a very small portion only had retained the light colour of Ceára rubber. The whole had become agglomerated by the adhesiveness of the little separate masses of which the sample was composed.

The sample was carefully torn to pieces and examined, a separate examination being made of the lighter and darker portions. The only difference found is in the much larger quantity of moisture met with in the lighter portions.

The sample differed considerably from the two samples of Ceára rubber received last year from Ceylon, and reported on to W. T. Thiselton Dyer, Esq., June 29th, 1882.

The Ceylon sample No. 1 was firm and free from stickiness when received, and has remained almost unaltered up to the time of writing this report, whilst sample No. 2 has become strongly resinified by oxidation. These were both light in colour when received and have remained so.

Even the lightest portions of the sample forming the subject of this report are much darker in colour than either of the samples examined in June 1882, and referred to above.

This of itself is not a matter of much importance, but taken as an indication of its unalterability, may be of some significance when the collection is made on a large scale.

The stickiness of the present sample renders it problematical how far it would be able to compete with the sample No. 1 collected in Ceylon.

It might have been possible to have given some assurance on this point if the time was stated how long this sample had been collected. In its present condition it is hardly equal to Ceára rubber from Brazil, although its general qualities are very encouraging.

Digested in alcohol both the lighter and dark portions gave up a considerable quantity of soluble matter; the darker kind became partly whitened, the greater portion being unaffected in this respect.

On washing and drying, the lighter portions lost 15·6 per cent., the darker portions lost only 2·9 per cent. The amount of ash obtained from the lighter portions was before washing 4·3 per cent., after washing 2·7 per cent. The darker portions yield before washing 4·2 per cent., after washing 2·3 per cent.

Mixed with the suitable proportion of sulphur and heated, both portions vulcanized remarkably well. It might have been expected that the least oxidized portions would have yielded a tougher and harder product when vulcanized, as compared with the darker portions, but in this respect no difference could be perceived.

(Signed) T. P. Bruce Warren,
Analytical Chemist to the India Rubber, Gutta Percha and Telegraph Company, Limited.

Silvertown: *August 29th, 1883.*

SOME ACCOUNT OF THE ERIA SILKWORM (*ATTACUS RICINI*) AND DIRECTIONS FOR ITS CULTIVATION.

In connection with the recent introduction from Assam of the Eria silkworm and the intended free distribution among the ryots who may wish to cultivate this silkworm of eggs or living pupa, it has been suggested that I should briefly draft a few rules regarding its treatment for the guidance of those who wish to undertake the experiment.

In the first place it is perhaps advisable that I should give a short account of its culture and utilization in Assam.

Beside their houses the Assamese have little patches of castor-oil plant, or a few large plants scattered in the hedges, and upon the leaves of these, plucked by women and children, the silkworms are fed in their houses upon trays of bamboo.

The worm produces nearly seven crops in the year, the average duration of a brood from egg to moth being about eight weeks. The Eria silk in Assam is grown entirely for home consumption, and each house grows only just as much as is required for the use of the inmates.

In place of being reeled, the Eria silk in Assam is drawn off in a coarse twine, after the cocoons have been softened by immersion in a ley of potash or cowdung and water, and this twine is woven into a coarse, warm, exceedingly durable fabric, for cold weather wear. Owing to the Assamese taking no precautions to protect their silkworms from the ravages of the ichneumon fly, immense numbers are destroyed by this insect. All the cocoons of this species which I saw and reared in Upper Assam were pure white in color: of the experimental importation from Assam, half were white and half were orange, while of the first brood reared in Mysore the whole were orange, the result probably of their parents having emerged from orange cocoons.

I am writing to Assam for a further batch of white cocoons only.

Whether or no there be in Mysore an ichneumon fly which will prey upon this species, I have not yet had time to discover, but while the experiment was young, and the numbers of the stock small, I thought it advisable to protect the worms by mosquito net from all possible harm. This it would not be easy for the ryots to do, and in Mysore it may not be necessary. It is however, most essential that the worms should be perfectly protected from ants, and this can be easily effected by feeding them upon trays of bamboo placed upon a bamboo rack, whose legs stand in earthen vessels full of water.

At the time of hatching, the eggs should be placed upon paper upon bamboo trays, and young and tender castor-oil leaves given them morning and evening at least, and if possible three times a day, *viz.*, morning, noon and evening. Fresh leaves should be placed over the stale ones which hold the worms, and after the latter have left the stale leaves for the fresh, the former should be removed and thrown away.

Excrement and dead leaves should be removed morning and evening, and the worms kept scrupulously clean and not too crowded. It would facilitate cleaning if the worms, after they have grown to a fair size, were fed upon an open bamboo rack placed upon the tray; in which case the excrement would fall through the rack which could be lifted off with the leaves and

worms upon it, and the dirt which has fallen upon the tray below be expeditiously thrown away.

The eggs laid in Mysore began to hatch in seven days after the first of them were laid, and the silkworms having changed three skins at intervals of six or seven days began to spin in 24 days from the commencement of the hatching of the eggs.

The worms should be fed under shelter, and should be kept plentifully supplied with fresh leaves.

The worms when full fed and desiring to spin change color and cease feeding, and evince a disposition to wander. At this period they should be closely watched, and collected as they leave the trays, and placed among dry leaves or crumpled paper in a basket or box to form their cocoons. The cocoons should not be disturbed for about four days, when they can be gently pulled off by one end from their attachments. If desired, exposure to the sun for three or four days, or baking in an oven of the cocoons will destroy the contained larva.

The moths emerge from the cocoons in about 16 days from the formation of the latter; and after pairing, commence to lay their eggs, which should be carefully preserved out of the reach of ants, and watched closely as the time of hatching (7 or 8 days after deposition) approaches.

The females may be tied on pieces of stick by a thread loosely placed round their waists, and be left in this position to receive the visits of the males, or the whole may be left together in a basket or box covered with mosquito net to perform their sexual functions.

It will facilitate preservation of the eggs if the impregnated females are transferred to closed baskets or boxes lined with paper, but perforated for admission of air. In all stages, whether egg, larva, moth, or pupa, it is absolutely essential that ants be excluded from obtaining access to the baskets, trays, or boxes containing the insects.

It is my intention to forward to Europe samples of Eria cocoons as soon as the large number of worms which we have at present shall have spun, and to ascertain at what rate the English and French manufacturers would be willing to purchase large quantities of Eria cocoons or silk.

Other experiments will also be made with regard to the local manufacture of silk cloth from Eria cocoons by the aid of the carding frame, and it is hoped that the growth and manufacture of Eria silk will ere long assume a prominent position among the industries of the Mysore Province.

CHARLES E. M. RUSSELL, M.R.A.C.,
Supdt. of Forests and Govt. Farms, Mysore District.

JJ. Notes, Queries and Extracts.

THE PREPARATION OF RHEEA FIBRE.

One of the most important economic questions that has presented itself for solution of late years is the utilisation of the rheea, or China grass plant—which is also known under the name of ramie—for textile purposes. And the importance of that question becomes national when considered in connection with our Indian and Colonial possessions. The difficulty in solving the question has not lain in the cultivation of the plant, for that point has long since been settled. Within certain limits rheea can be grown in any climate, and India and the British colonies offer unusual facilities, and present vast and appropriate fields for that enterprise, while it can be, and is, grown in most European countries. All this has long been demonstrated; not so, however, the commercial utilisation of the fibre, which up to the present time would appear to be a problem only partially solved, notwithstanding the time, thought, labour, and capital expended upon it. The difficulty has lain in the decortication of the stems of the plant, and four times during the present century official action has been taken by the Government in the endeavour to elucidate the question. The first effort for utilising the plant dates from 1803, when Dr. Roxburgh started the question, and the second from 1840, when attention was again directed to it by Colonel Jenkins. The third attempt in this direction was made in 1869, when the Indian Government offered a reward of £5,000 for the best machine for separating the fibre from the stems and bark of rheea in its green or freshly cut state. The Indian Government was led to this step by the strong conviction, based upon ample evidence, that the only obstacle to the development of an extensive trade in this product was the want of suitable means for decorticating the plant. This offer, however, led to only one machine being submitted for trial, although several competitors had entered their names. This apparatus was that of Mr. Greig, of Edinburgh, but after careful trial by General (then Lieutenant-Colonel) Hyde it was found that it did not fulfil the conditions laid down by the Government, and therefore the full price of £5,000 was not awarded. In consideration, however, of the inventor having made a *bonâ fide* and meritorious attempt to solve the question, he was awarded a donation of £1,500. Other unsuccessful attempts were subsequently made, and eventually the Government found themselves obliged to withdraw

the offered prize. This, however, was only for a time, for invention was still rife in this direction, and in 1881 the Government re-offered the £5,000. Another competition took place, at which several machines were tried, but the trials, as before, proved barren of any practical results, and up to the present time no machine has been found capable of dealing successfully with this plant in the green state.

The withdrawal of the stimulus, however, does not appear to have damped inventive ardour, for the subject was still pursued in many directions. Nor can we wonder at this when we remember the value of the fibre as regards strength. This was shown in the case of some rheea fibre from Assam experimented with in 1852 by Dr. Forbes Royle, which, as compared with St. Petersburg hemp, was in the ratio of 280 to 160, while the wild rheea from Assam was as high as 343. But, above and beyond this, rheea has the widest range of possible applications of any fibre as shown by an exhaustive report now before us on the preparation and use of rheea fibre by Dr. Forbes Watson, published in 1875, at which date Dr. Watson was the reporter on the products of India to the Secretary of State at the India Office. Amongst the fibres which already enter largely into textile manufactures, flax is perhaps the one which possesses the most extended range of application—from the roughest canvas and cordage to the finest lace; yet the range of rheea is even greater still. Dr. Watson points out that this is due partly to the superlative degree in which it possesses certain qualities, such as fineness, strength, and lustre, not usually associated in the same perfection in any single fibre, and partly to the curious intermediate position which it holds between the usual vegetable and animal fibres. Although a vegetable fibre, its hairiness assimilates it to wool, and its gloss and fineness to silk. The resemblance to wool rheea shows in common with other nettles—the Neilgherry nettle, for instance, which is, however, so very rough and hairy that it could never compete with smooth fibres such as flax, whereas rheea can be rendered fit for either use. Thus rheea combines the whole range of applications of hemp, to which it is superior in almost every respect, with almost the whole range of the uses of flax, excepting, perhaps, its use for body linen, together with certain other uses for which only the animal fibres, wool and silk, have hitherto been employed. Amongst others who have sought to render China grass available for the spinner is M. A. Favier, and he succeeded about a year ago in solving the question of decortication in the green state in a satisfactory manner. M. Favier's process—the experiments with which were reported by us at the time*—consists in subjecting the plant to the action of steam for a period varying from ten to twenty-five minutes

* *Vide* IRON, Vol. XX., page 80.

according to the length of time the plant has been cut. After steaming, the fibre and its adjuncts were easily stripped from the wood. The importance and value of this invention will be realised when it is remembered that the plant is cultivated at long distances from the localities where the fibre is prepared for the market. The consequence is that for every hundred weight of fibre about a ton of woody material has to be transported. Nor is this the only evil, for the gummy matter in which the fibre is embedded becomes dried up during transport, and the separtion of the fibre is thus rendered difficult and even impossible, inasmuch as some of the fibre is left adhering to the wood. It will thus be seen that M. Favier's process greatly simplifies the commercial production of the fibre up to a certain point, for, at a very small cost, it gives the manufacturer the whole of the fibre in the plant treated. But it still stops short of what is required in that it delivers the fibre in ribands with its cementitious matter and outer skin attached. To remove this, various methods have been tried, but, as far as we are aware, without general success—that is to say, the fibre cannot always be obtained of such a uniformly good quality as to constitute a commercially reliable article. The fact is, attention has been too largely given to mechanical methods of manipulation and too little to chemical processes.

Seeing, then, that decortication had been successfully accomplished without the aid of machinery, it occurred to Messrs. G. W. H. Brogden & Co., of Gresham House, London, who had interested themselves in M. Favier's invention, that the process of utilisation might be carried forward in a similar manner—that is, without mechanical aid. To this end, they submitted the matter to the distinguished French chemist, Professor Frémy, Member of the Institute of France, who is well known for his researches into the nature of fibrous plants and the question of their preparation for the market. Professor Frémy thoroughly investigated the matter from a chemical point of view, and at length brought it to a successful and what appears to us, on investigation, to be a practical issue. And here we may observe that one great bar to previous success was the absence of exact knowledge as to the nature of the constituents of that portion of the plant which contains the fibre, or, in other words, the casing or bark surrounding the woody stem of the rheea. Professor Frémy therefore commenced to investigate in this direction, and, as determined by him, the casing consists of the cutose, or outer skin, within which is the vasculose containing the fibre and other conjoined matter known as cellulose, between which and the woody stem is the pectose or gum which causes the skin or bark as a whole, fibre included, to adhere to the wood. The Professor next proceeded to ascertain the nature of these various substances, and in the result he found that the vasculose and pectose were soluble

in an alkali under certain conditions, and that the cellulose was insoluble. He then sought a method of releasing the fibre from its imprisonment, which object he effects by dissolving out the cutose, vasculose, and pectose by a very simple process, obtaining the fibre clean and free from all extraneous adherent matter and ready for the spinner. In order, however, to ensure as a result a perfectly uniform and marketable article, the Professor uses various chemicals at the several stages of the process. These, however, are not administered haphazard or by rule of thumb, as has been the case in some processes bearing in the same direction, and which have consequently failed in the sense that they have not yet taken their places as commercial successes. Professor Frémy therefore submits the plant which he has to treat, to careful examination, and, according to its nature and the character of its components, he determines the proportions and nature of the various chemicals to be employed at the several stages. The possibility of failure thus appears to be eliminated, and the production of a fibre of uniform and reliable quality, no longer remains a matter of chance, but is rendered a comparative certainty. The success of the two processes of M. Favier and M. Frémy having been assured experimentally, it was determined to combine their working in one continuous operation. Machinery was therefore put up in France on a scale sufficiently large to fairly approximate to practical working, and to demonstrate the practicability of the combined inventions. The experimental works are situated in the Route d'Orleans, Grand Montrouge, just outside Paris, and a series of demonstrations were recently given there by Messrs. G. W. H. Brogden & Co., of Gresham House, London. The trials were carried out by M. Albert Alfroy under the supervision of M. Urbain, who is Professor Frémy's Chief Assistant and Co-patentee, and were attended by Dr. Forbes Watson, Mr. C. E. Collyer, Mr. C. J. Taylor, late Member of the General Assembly, New Zealand, Mr. Healy (lately from India), M. Barbe, M. Favier, Mr. G. Brogden, Mr. Casper, Mr. Perry F. Nursey, C.E., and a number of other gentlemen representing those interested in the matter under consideration.

The trials extended over several days, and were most interesting, involving as they did the combined processes and their application to rheea grown in France and England. The French plants treated were grown at La Reolle, near Bordeaux, whilst the English specimens were grown at Strathfieldsaye by the Duke of Wellington, who has taken an active interest in the question at issue for some years past. The English rheea was taken by Dr. Forbes Watson, who carried out some special experiments with it. One of the objects of Dr. Watson's experiments was, by treating rheea cut at certain stages of growth, to ascertain at which stage the plant yields the best fibre, and consequently how many crops can be raised in the year with the

best advantage. This question has often presented itself as one of the points to be determined, and advantage has been taken of the present opportunity with a view to the solution of the question. Mr. C. J. Taylor also took with him a sample of New Zealand flax, which was successfully treated by the process. In all cases the rheea was used in its green state and was comparatively freshly cut. As carried out at Montrouge the process consists in first treating the rheea according to M. Favier's invention. The apparatus employed for this purpose is very simple and inexpensive, consisting merely of a stout deal trough or box about 8 feet long, 2 feet wide, and 1 foot 8 inches deep. The box has a hinged lid and a false open bottom, under which steam at a low pressure is admitted by a perforated pipe, there being an outlet for the condensed water at one end of the box. Into this box the bundles of rheea were placed, the lid closed, steam turned on, and in about twenty minutes it was invariably found that the bark had been sufficiently softened to allow of its being readily and rapidly stripped off by hand, together with the whole of the fibre, in what may be called ribands. Thus the process of decortication is effectively accomplished in a few minutes, instead of requiring, as it sometimes does in the retting process, days and even weeks, and being at the best attended with uncertainty as to results, as is also the case when decortication is effected by machinery. Moreover, the retting process, which is simply steeping the cut plants in water, is a delicate operation, requiring constant watching, to say nothing of its serious inconvenience from a sanitary point of view on account of the pestilential emanations from the retteries. In fact, retting is considered by some as wholly inapplicable to rheea, as the fermentation is so rapid and energetic that it may easily become destructive to the fibre. Moreover, the tops of the items are much more tender than the lower and more woody portions, so that the upper parts stand a chance of being over-retted, and the fibre entirely spoilt before the lower thicker woody sticks have been attacked by fermentation. The same difference may also occur in the stems themselves, some in the same crop being slender and succulent, whilst others are much more fully developed and woody. But to return to the process, decortication by steam having been effected, the work of M. Favier ceases, and the process is now carried forward by M. Frémy. The ribands having been produced, the fibre in them has to be freed from the surrounding mucilaginous secretions. To this end, after examination in the laboratory, they are laid on circular metal trays, which are placed one above the other a short distance apart in a vertical perforated metal cylinder. When charged this cylinder is placed within a strong iron cylinder containing a known quantity of water, to which an alkali is added in certain proportions. Within the cylinder is a steam coil for heating the water, and, steam having been turned on, the tem-

perature is raised to a certain point, when the cylinder is closed steam-tight. The process of boiling is continued under pressure until the temperature—and consequently the steam pressure—within the cylinder has attained a high degree. On the completion of this part of the process, which occupies about four hours, and upon the careful carrying out of which the success of the whole mainly depends, the cementitious matter surrounding the fibre is found to have been transformed into a substance easily dissolved. The fibrous mass is then removed to a centrifugal machine, in which it is deprived of its surplus alkaline moisture, and it is then placed in a weak solution of hydrochloric acid for a short time. It is then transferred to a bath of pure cold water, in which it remains for about an hour, and it is subsequently placed for a short time in a weak acid bath, after which it is again washed in cold water, and dried for the market.

It is a very easy thing to watch and detail the various operations connected with this ingenious process, but it can afford no indication of the amount of time and labour, mental and physical, expended upon it in bringing it to its present successful issue. This indication, however, was afforded to those who followed the operations at Montrouge by a highly interesting visit to the government laboratory in Paris, of which Professor Frémy is Chief and M. Urbain *sous-chef*, and where those gentlemen explained the details of their process and made their visitors familiar with the progressive steps of their investigations. There they were shown the various constituents of the bark—taken as a whole—of the rheea, as well as numerous samples of the fibre produced by the processes we have described, many of which had the most delicate silky appearance. The visitors also proceeded to Louviers, near Rouen, where a factory has been acquired, in which there is machinery already erected for preparing the fibre according to the processes we have described at the rate of one ton per day. There is also machinery for spinning the fibre into yarns.

Such, then, are the means by which it is expected the China grass will be enabled to compete successfully with other fibrous plants. The results of the combined processes justify this expectation, being, so far as they go, eminently satisfactory. If generally adopted, they will not only enable the fibre to be produced at a much lower cost, and much better in quality than hitherto, but they will doubtless lead to the successful utilisation of vast tracts of eligible land for the cultivation of China grass, land upon which, up to the present, its cultivation would not pay on account of the heavy cost of transport from the field to the works. The successful issue would prove a boon to India and our Colonies, whilst the industry might also be pursued much nearer home owing to the adaptability of the plant to a wide range of climate. It appears to be the solution of a great

industrial problem, and we hope to see the new industry to which it points fully developed.

The problem of the mechanical preparation of rheea fibre—which is practically identical with China grass—has for many years past occupied the attention of engineers and inventors, but until very recently its solution appeared as far off as it was at the commencement of the present century, when the question was first taken up by the Government. Endeavours have long been made in various directions to utilise this plant for the production of textile fabrics, but without general success, owing to the difficulties attending its profitable decortication. Four times within the present century has rheea been the subject of official action, while within the last fourteen years a prize of £5,000 has been twice offered by the Indian Government, twice competed for, and twice withdrawn in consequence of all the mechanical means submitted for trial having failed to meet the requirements of the Government. We have, however, recently had an opportunity of inspecting the working of a machine which appears most effectually to dispose of the question. It separates the fibre from the woody stem of the green rheea, and at the same time cleanses it from all extraneous adherent matter, producing it in good condition for the market, and this without any previous or subsequent treatment. This machine is the invention of Mr. H. C. Smith, and is manufactured by Messrs. Death and Ellwood, of Leicester. It consists of a cast-iron framing about 3 feet high, 2 feet wide, and 3 feet deep from front to back, carrying a revolving drum about 18 inches in diameter and 12 inches wide. The drum is fitted with a series of beaters which pass near to the edge of a feeding table about 12 inches wide, the drum being covered in with an iron hood. From beneath the feeding table a thin sheet of water is made to play in a constant stream against the drum at a certain pressure and angle, and this constitutes the whole of the apparatus. The fibrous plants are fed in by hand on the feeding table, and are simply held up to the beaters by a cushion or backing of water, by which means the whole of the extraneous matter is removed, and the fibre produced in a remarkably short time and in excellent condition. The secret of success is undoubtedly due to the backing of water, which offers a yielding medium for holding up each and every fibre, individually, to the action of the beaters.

The machine has been invented about a year, and several have been made and sent out to India, where they are now doing good work upon various kinds of fibrous plants. It does not, however, appear to have hitherto occurred to anyone to try the effect of the machine in preparing the fibre of the rheea plant. This was probably on account of the woody nature of the rheea stalk, which, it might be assumed, would cause dam-

age to the fibre if the stalk were beaten in a machine running at a high velocity. A few weeks since, however, the machine was brought under the notice of Dr. Forbes Watson, who, from his long practical acquaintance with fibrous plants, at once conceived the idea that with the water backing it would successfully treat the rheea. He therefore at once put the machine to the test, and found that his surmises were correct, and that rheea fibre could be effectually produced in a simple and speedy manner. A private demonstration at which we were present was recently given at Messrs. George Jennings's Works, Stangate Wharf, Lambeth, upon which occasion there were present General Hyde, of the India Office, the Hon. Henry Berkeley, Mr. C. E. Collyer, and the representatives of some of the leading firms in the fibre trade. The experiments were conducted by Dr. Forbes Watson, and consisted primarily in the treatment of some rheea grown in England, as well as other stalks of rheea grown in France. It should be observed that in practice the rheea would be treated freshly cut and in its green and juicy condition. In the present instance, however, the English stalks were cut on the 30th of October, and although they had been as far as possible preserved green, they were not of course in a condition to justify the expectation of the best results. But notwithstanding this they were all successfully treated, the fibre coming out much better than had been anticipated. In one of the tests 115 stems of the French rheea were treated by the operator, and the fibre produced clean and free from all adherent articles in three and three-quarter minutes, thus showing the rapidity with which the work can be carried on. Besides the rheea several varieties of fibrous plants were put through the machine, including the *Fourcroya gigantea*, an Indian aloe, the *Sanseveira zeylanica*, or bowstring hemp, as it is called by the natives, the yucca, and the *Phormium tenax* or New Zealand flax. All these were successfully treated, and, considering that none of them were freshly cut, and that, moreover, they were garden specimens of the various species, the fibre left the machine in a clean and satisfactory condition. It was thus amply shown that the solution of the problem of the mechanical preparation of rheea fibre had been at length effectually solved. The opinion of several experts in the matter of fibres was that the treatment of the rheea plant had been fully and fairly accomplished. The invention is in the hands of Mr. C. E. Collyer, of 141, Fenchurch Street, London, who showed the visitors some samples of fibre of the *Sanseveira zeylanica* and the *Fourcroya gigantea* which had been prepared by the machines in India and sent over in bales by Messrs. Staines and Co., of Coimbatore, Madras, and with which the fibre just produced from the same species of plant compared favourably, considering the unfavourable circumstances, already referred to, under which the demonstration was carried out.—*Iron.*

DEAD BRANCHES DETRIMENTAL.—I have been asked whether the statement lately going the rounds of the American papers that "a dead branch on a tree makes almost as great a strain on the main plant for moisture as does a living one" is accurate or not. The statement is coupled with another referring to its practical application in tree culture, the conclusion being that every dead branch "should be at once cut away." Briefly it might be answered that the first statement is true in the main, and that, without any doubt at all, the conclusion is a wise one, and ought to be followed in practice. To explain this matter will take considerably more space, and in order to understand it we must go to vegetable physiology and enquire into the nature of the evaporation of water from plants. It was long supposed to be a physiological process, and was considered to be entirely different from ordinary physical evaporation. As long as this view was held the process was called transpiration, to distinguish it from the physical process. The breathing pores, the stomata, which occur in the epidermis of all leaves in great numbers, were supposed to be organs of transpiration, which was considered to be one of the most important functions of the leaf.

Within a few years, however, our knowledge of these matters has been greatly increased, and we now know that the escape of water from the leaf does not differ in any way from the evaporation of water from any other moist surface. A leaf is a mass of cells, every one of which is gorged with watery matter, which in a dry atmosphere, as a matter of course, tends to escape. The epidermis, composed of dryish impervious cells, which entirely surrounds the watery cells of the leaf, would prevent almost completely the evaporation of water from the latter were it not for the breathing pores before mentioned. These pores are for permitting the free ingress and egress of gases, particularly oxygen, carbonic acid, and probably, also ammonia. Now, when the pores are open for their legitimate purpose, it happens that more or less water escapes if the air is dry. If the air happens to be very moist, the loss of water through the breathing pores is very little, or even none at all.*

We may put it in this way: The leaf loses water simply because it is a watery structure; its epidermis is designed to prevent this loss, and the breathing pores with their power of opening and closing are for the same purpose. A leaf instead of being an organ of evaporation is actually a structure in which evaporation is quite successfully checked. Careful experiments made under my supervision in the Iowa Agricultural College in 1880 by Miss Ida Twitchell, a graduate student, demonstrated that the evaporation from a moist piece of dead wood was exactly like that from a living leaf. Now, when a dead branch

* This is contradicted by McNab, "Outlines of Botany," page 100, who states, as the result of experiments made by himself, that transpiration in a saturated atmosphere with sunshine, as in a greenhouse, is greater than in dry air.—[ED.]

is long enough to keep continually moist in the interior, it will in dry air constantly lose water by evaporation from its surface. This water so lost is taken from the tree, and must have been supplied directly or indirectly by the living portions. Moreover, it must be remembered that a living branch is well protected against loss of water through evaporation by the epidermis which covers all its surface when young, or the impervious corky bark which is always found on it when older. When a branch dies, these protecting devices soon fall into decay, and the water, so carefully guarded by the living parts of the plant, is wasted by evaporation.—PROF. C. E. BESSEY (in the *New York Tribune.*)—*Journal of Horticulture.*

TUSSER SILK IN CHOTA NAGPUR.—The following extract is from the Appendix to the Administration Report of the Chota Nagpur Division for the year 1882-83 :—

About Rs. 89,000 worth of tusser cocoons, manufactured into silk, were exported from Hazaribagh to Moorshedabad and other places, while from Manbhoom and Singbhoom 2,500 and 10,600 kahans respectively of the cocoons were exported during the past year, against the same quantity exported from Singbhoom and 7,500 kahans exported from Manbhoom in 1881-82. The Deputy Commissioners of Singbhoom and Manbhoom are both of opinion that the yield of cocoons in the past year in both districts was very large, though the Singbhoom ryots, to whom I spoke on the subject, complained of the small crop they had got ; while the Deputy Commissioner of Singbhoom says that the low rate at which they were sold in the market prevented a large quantity from being exported.

I have for several years past been engaged in making enquiries about the tusser industry, which might possibly, under efficient and intelligent management, become a source of great wealth to the Division.

Tusser cocoons at present are grown either in the jungle tracts of Singbhoom and the Tributary States, or in Manbhoom and the villages in the east of the Lohardugga and Hazaribagh districts. In the jungle tracts they are grown chiefly in the jungle surrounding villages in which there is little cleared land, and the yield from these villages is yearly decreasing, as the extension of clearances moves the jungles further from the village site. More than once I have asked the people why they had given up growing tusser in these villages. They have said, "Why, sahib, when we grew tusser the jungle was close to our houses, but now look how far off it is." As native superstition requires the tusser grower and all his family to submit to a number of ascetic observances, without which a good crop cannot be expected, the people naturally give up growing a crop which entails so much trouble and long journey to the jungles, when they can get very

nearly, if not quite, as large profits from crops grown close to their doors without half the labour and annoyance required by the rules of tusser cultivation.

In the more cultivated villages of Singbhoom, Lohardugga, Manbhoom, and East Hazaribagh the tusser worms are fed on pollarded asun* trees, some of which have been planted for the purpose, but the greater number are remnants of the jungle which once surrounded the village. The usual number of trees tended by each man is from 10 to 20. The average yield, as far as I could ascertain from enquiries made from a number of tusser-cultivators in Singbhoom, is about 30 cocoons per tree, though in a good year a tree ought to yield about 100 cocoons, so that the average number of cocoons yielded by an average of 15 trees is about 450; and if the price paid be 8 annas per 80 cocoons, all that he and his family get for their watch of about a month, continued day and night, is a little more than Rs. 5-8. If this were all that could be looked for, the number of people who would go through the drudgery of watching, and the minute observances as to cleanliness and food necessary, would be very small. It is only the chance of a bumper crop of 100 cocoons or more per tree that induces cultivators to try their luck in the trade. The number who cultivate tusser is yearly decreasing, and will decline very considerably in a series of years if heavy rain and wind should make the yield as bad as it was last year in Eastern Lohardugga.

On the other hand, a largely increasing demand for tusser is springing up in England, and during my stay there last year I visited Maclesfield, and spent some days with Mr. Brockleburst, who owns the largest silk mills in that city, and discussed the subject with him and Mr. Wardle, who superintended the preparation of the dyed silks sent by the India Office to the Paris Exhibition, is the head of a large dyeing firm at Leeds, and has been for years engaged in making experiments in dyeing tusser.

From what I learnt from them, and from some correspondence I have had with Mr. Wardle, it appears that the English silk firms are prepared to take any quantity of tusser waste at from 1*s.* to 1*s.* 6*d.* a pound, but that higher prices for unreeled silk would not now pay in England, while at anything like present rates for cocoons here this price would be utterly unremunerative. Now they can get large supplies from China at these rates, but they have no information whether these supplies will keep pace with the increasing demands of the trade, or whether the China worm, which feeds on the oak-tree, is domesticated or feeds in the jungles. In the latter case the supply is not likely to be largely increased, and a rise in prices, if the demand still continues, may, if the work of production could be reduced, make the export even of Indian tusser waste pay.

* *Terminalia tomentosa.*

The China tusser silk is naturally white, and does not require bleaching, whereas it is a very difficult matter to bleach the Indian tusser. The latter is therefore much more expensive than the Chinese for all white silks, and can only compete with it at present prices in dyed goods and those of its natural colour; but Mr. Wardle writes to me on the 10th March this year—"I should be much delighted if Indian tusser could replace Chinese; I find it is preferred by the spinners." But except when used as waste, he says—"It must be reeled where labour is cheap," as it will not pay for reeling in England.

The price of reeled China tusser given by him in the letter above quoted is from 5*s.* to 5*s.* 6*d.* per pound; but to make a pound of silk according to Major Cousmaker's experiments requires an average of 436 cocoons; and though the cocoons of Chota Nagpur are larger than those of Bombay, where Major Cousmaker's experiments were made, yet as far as I learn from enquiries among the natives, his estimate must be considered to represent very fairly the outturn from cocoons in this country. At the rate of 8 annas for eighty cocoons, the cost of obtaining a pound of silk would be more than Rs. 2-8, or about the price of the best reeled China silk at home without the cost of reeling. Therefore, before even reeled tusser can pay exporters well, the price at home must be increased, or the cost of production must be materially reduced. Feeding tusser worms on asun trees will never pay, as the trees cover a large space, and the yield of the number of trees which one or one family can look after is very small; but if ryots could be induced to plant hedges of *Lagerstræmia indica* (a shrub on which Major Cousmaker successfully reared cocoons in Bombay) in the gardens close to their houses as they now plant opium and vegetables, the yield of cocoons could be very largely increased. On an acre of wide-spreading asun trees only about 440 trees, yielding an average crop of about 13,000 cocoons, could be grown; whereas Major Cousmaker has reared an average of 20,205 cocoons to the acre on *Lagerstræmia*, and probably more could be reared on hedges close to a ryot's house and constantly looked after by himself and his family. But of course the ryots will not do this without the hopes of a large profit, and they must therefore be able to get from the small patches of *Lagerstræmia* they can plant in their gardens more than they now get from the few asun trees they can look after. If a man now gets an average of only about Rs. 5-8, and the industry is declining, it will require at least an average receipt of Rs. 8 to make the cultivation fairly popular; while, if it could be increased to Rs. 10, the number of tusser cultivators would be very largely increased, but only if a family can look after about an acre of hedge planted about two feet apart, and it is only by experiment that an area a family can look after can be ascertained. In order to make a profit on reeled silk at present prices, it would, considering the expenses

of setting up and maintaining filatures with reeling machines, added to those of supervision and transport, be necessary to be able to buy the cocoons at not more that 2*s.* or Re. 1 for the quantity required to make a pound of silk. This would be about in round numbers 440 cocoons, or 110 for 4 annas—a price much less than that now given; but if, on the other hand, the average yield could be raised to 20,000 cocoons an acre by substituting *Lagerstræmia* hedges for asun trees, a ryot could on one-fifth of an acre procure cocoons which he would sell for nearly Rs. 10 at the filature.

Here, however, another question would arise—Could a ryot and his family look after more than one-fifth of an acre? and if they could not, I very much doubt whether the prospect of getting only Rs. 10 would be held by the more enterprising ryots, such as Kooiries and Koormis, who would alone undertake the cultivation of a *Lagerstræmia* plot, to be sufficient to compensate them for their trouble, especially as the cocoons must be brought to the filature before this price could be got. I am afraid this would detract greatly from the attractions which the receipt of Rs. 50 for the crop grown on an acre would present if tusser only required the care requisite for ordinary crops. Therefore, even supposing that a pioneer of the trade did appear possessed of the very sure qualities necessary to overcome prejudices of the ryots, the capital necessary to make a profit after many failures and a patience not easily discouraged, the success of his endeavours would be doubtful; but if he did succeed, I believe that owing to the increasing demand for tusser he would make a large fortune, provided the facilities for increasing production in China are not greater than those in India; and as one successful experimentalist would find his example followed by many others, the wealth of the country would be enormously increased by a large and prosperous trade, which would, owing to the cheapness and abundance of labour which the country will probably always furnish, and the probable absence of competition from other countries if Chinese tusser is once beaten out of the market, be likely to be permanent.

FORESTRY AT HOME AND ABROAD.—Vast as the available mineral wealth of the world undoubtedly is, in utilising such items of it as coal and iron, there is the disquieting feeling that every year's consumption is a slice irretrievably gone from the whole. With timber the case is different, for if the advice of the old laird of Dumbiedykes to his son, "to be aye sticking in a tree, for it will grow while you are sleeping," be adequately followed, a perennial supply of wood is assured. If this planting of trees has been too much neglected in the past, it is so far due to the fact that for a long period re-afforesting was not only unnecessary but mischievous. The forests got, by ever so many ages,

the start of man in the struggle for possession of the earth's surface, and since the advent of man he has had toilsomely to win back the soil from the primeval forest. Trees, however, play an important part in the general economy of the globe, and the preservation of an adequate amount of forest is as essential to human interests as is the removal of the remainder. Timber is everywhere a prime necessity for constructive purposes, and in most parts of the world it is the only fuel. Equally important is its climatic influence. Although not increasing the rainfall, forests husband the rain after it has fallen, and so prevent its too rapid flow from the soil. They thus help to regulate the flow of rivers and to prevent disastrous floods, while by checking evaporation they modify the temperature. They further protect the soil from denudation, especially on mountain sides, which, exposed to rain and torrents, soon gets washed away. It has only been by sad experience that those climatic effects of disforesting have been discovered. Turkey, Italy, France, and Spain have all suffered severely from the denudation due to the destruction of the forests which once clad their mountain slopes, and historians have attributed the decadence of Spain largely to this cause. The barrenness of the once fertile Palestine, of Syria, and of Cyprus has been brought about in the same way, while the famines of India and China can be much more certainly traced to the disappearance of their mountain forests than to the coming or going of sunspots. While many countries have thus reduced their area of forest below what is absolutely required for the maintenance of the best physical conditions, as large a number find the home supply of timber inadequate for their economic wants. Great Britain thus imports most of its timber, and the same is true, though to a much less extent, of the principal European nations. The chief sources of timber supply are Scandinavia, Russia, and North America. The last is still comparatively rich in primeval forest, but forest fires, the browsing of cattle and consequent destruction of seedlings, and the growing demand for timber by the Americans themselves for industrial purposes, are bringing the time within measurable distance when the New World will have need for all its forests. If proof of this were required, it is to be found in the fact that at the present time the forest acreage of the United States is less than a fourth of the total surface—a smaller proportion than is found in Russia, Sweden, and Austria, and about the same as that in thickly-peopled Prussia. It was also noted in these columns a few days ago with regard to Canada that the consumption of coal had doubled in eight years, owing partly to the great and increasing scarcity of wood in the settled districts. The timber exporting countries of Europe are believed to have already reached the limit of their capacity in this respect. With an ever-increasing demand for timber, therefore, the prospect that the supply will keep pace with it is not

reassuring. Certain it is that in the future more attention will have to be paid to the formation and management of woods, and to the utilisation for this purpose of waste lands, if the future progress of civilisation is not to be impeded by the scarcity of timber.

With its moist climate, its abundance of coal, and its great facilities for importing timber, Britain does not greatly feel the inconvenience of depending on other countries for its wood supplies, and consequently it has given little attention to the growing of timber. Less fortunate in these respects, Continental nations have been led by the force of circumstances to study the science and practise the art of forestry with a devotion altogether unknown in this country. In Germany and France, for example, a forest is regarded as so much capital, represented by so many cubic feet of wood, while "the amount of wood"—to quote from a recent paper by Colonel Pearson—"produced each year by its growth represents the interest thereon, and, in fact, is the revenue of the forest." A quantity of timber equal to the annual increase of wood can, therefore, be cut down without diminishing the original volume of wood. That the greatest possible revenue may be obtained, Continental foresters see that the productive powers of the soil are utilised to the utmost, also that the annual revenue of wood is taken from the ground in the way that shall least interfere with the continuous growth of the forest. In this latter matter the English differs from the Continental practice. In this country it is the usual custom to cut down the mature crop and to plant again; on the Continent the annual revenue of timber is obtained by cutting down a tree here and another there, the gaps thus caused in the forest being left to be filled up by seedlings naturally sown. The thoroughness which characterises the management of the timber crop in such countries as Germany is seen in the accurate maps that are prepared of the various forest districts, with accompanying descriptions of the kind of timber and of the age of the trees in each. There is thus not a tree in any of the woods, big or small, that is not recorded, and that has not its future marked out for it in the working plan of the forest of which it belongs. The intelligence displayed in the management of Continental forests is due to the excellent training received by those in charge of them in the Schools of Forestry. These were founded in Germany so early as the year 1717, and now they are to be found in every important European country except Britain. Austria, according to a recent return, possesses nine of these schools, each with its director and a staff of professors numbering from two to twelve. The small Kingdom of Saxony has its forestry academy, with ten professors and assistants. Prussia has three such institutions, with a total professoriate of 29; while there are no fewer than six classes of forestry in the University of Munich. France has fewer

forestry schools, but in the great institution at Nancy, founded in 1824, she possesses probably the best specimen of its kind in the world. Russia has four such schools, while Italy, Denmark, Sweden, Switzerland, and even Spain, have each at least one establishment for the training of foresters. The course of instruction is, as a rule, extensive and thorough, for, besides forest-culture, it usually includes such subjects as botany, zoology, entomology, mineralogy, geology, and chemistry, besides geodesy and draughting. Candidates for admission to those forest academies are selected with great care, only those who have attained a high standard of education, and who are able to maintain themselves throughout their course of study, being admitted. The result, according to a recent account of German forestry, is that "a thorough forester in Prussia is an adept in natural history relative to forests and their inhabitants, at the same time a geologist, botanist, and chemist, and the possessor of a good general knowledge of the laws of his country. He knows every foot of land in his district; at the various stations he notes the rainfall, the force and direction of the prevailing winds, their humidity and dryness, the temperature, &c."

The neglect of forestry in Britain, as shown in the total absence of schools of forestry, is all the more remarkable from the fact that a demand exists for the education such schools can alone supply. A knowledge of forestry is required by candidates for the Indian Forest Service, and to obtain it men are sent from this country to study at the French academy in Nancy. It is a fact that the British Empire presents the most extensive forests of any country in the world, these having an area of 340,000,000 acres, and already the need of proper forest management is being felt throughout our vast foreign and colonial possessions. The conservation of the forests of India, and the re-afforesting of tracts that have suffered from the injudicious removal of timber, now forms one of the most important departments of Indian administration. The Government of the Cape has lately become alive to the necessity of preserving its forests, and, for lack of a properly-qualified English forester, they have had to give the appointment of Forest Commissioner, with a salary of £800 per annum, to a Frenchman, who does not even know our language. The forests of Cyprus have also recently been put under charge of a French forester. With India and the Colonies to supply, a British School of Forestry ought to be one of the most flourishing educational institutions in the country. The demand for foresters at home is certainly not great. Scarcely 4 per cent. of the acreage of Great Britain is covered with wood, and not $1\frac{3}{4}$ per cent. of Ireland, as compared with 16 per cent. in France, 23 in Prussia, 31 in Austria, and $42\frac{1}{2}$ in Russia. This, however, is no reason why the little we have—and 2,500,000 is not so contemptible an acreage of forest, after all—should not be laid out and managed to the best

advantage. With the exception of 125,000 acres of Crown forests—Windsor Park, New Forest, and the Forest of Dean—which are under careful management, all our woods and plantations, are in the hands of private owners. That judicious, and consequently profitable management of these has been the exception is not surprising, since the owners, without instruction themselves in the science and art of forestry, have not been able to obtain the services of properly trained foresters. The question also arises whether our acreage of wood could not be considerably and profitably increased. It would be obviously foolish to plant timber on land that might be put to better use, but there are, as was pointed out by Sir J. Lubbock lately in the House of Commons, in Scotland and Wales alone from 5 to 6 millions of acres of land at present almost valueless, and much of which, especially on the sides of hills and slopes, might, in the opinion of competent authorities, be advantageously planted with trees. Ireland is one of the least wooded countries of Europe; it has, however, extensive waste lands, which from their situation and character would never repay the cost of reclamation for purposes of tillage. These might by re-afforesting be brought to yield a large revenue, to the great benefit of the sister isle. What may be done in this way, at a comparatively small cost, was lately shown by Viscount Powerscourt in a letter to the *Times*, in which he gave particulars of the planting of 1000 acres of wood on a hitherto waste part of his estates in county Wicklow. The profitable working of the present woodlands would, however, prove the strongest inducement to proprietors to plant timber on their waste lands, and nothing would more hasten such a consummation than the establishment in this country of a thoroughly equipped school of forestry, from which men competent to form and manage forests could be obtained. Apathy, born of ignorance, is, it must be confessed, the attitude of the British public on the question of forestry education. Probably no better method of enlightening the country as to the aims and methods of scientific sylviculture could have been hit upon than that of holding a great International Forestry Exhibition.—*Weekly Scotsman.*

BELIZE.—An interesting article concerning the topography, climate, and industries of Spanish Honduras, written by one of a party of Americans during a short trip into the interior, was recently given in the New Orleans *Lumberman*. We make the few following extracts concerning the Mahogany industry of the country :—Belize is the largest port on this side of Central America, says the writer, and the largest export port for mahogany. The exports of mahogany last year equalled 5,000,000 superficial feet, and it is estimated that during the current year the amount will reach 7,000,000 feet. One-half of this is

handled by the Belize Estate Company. The weight of the mahogany is estimated at 5,000 pounds to the 1,000 superficial feet, and about 10 per cent. less when seasoned. The freight to England is ten dols. per ton. We visited one church which has an altar made of seventy different kinds of native woods, all of which were very beautiful and susceptible of a fine finish. We afterwards visited a native cabinet shop which was of the most primitive style imaginable. Whip saws were used for sawing timber. A Mr. Kindred, long engaged in trade, informed us that his firm hauled their wood from 6 to 10 miles on carts, also ran some wood a long distance through ditches and canals. One log, recently handled, had to be hewn down from 7 feet in diameter in order to float it in their canal to market, wasting fully three-sevenths of the log.

The streets of Belize are narrow and irregular, but are kept very clean. The police are blackmen. The bush is very dense and hunters are sent out who mark the trees, and put a corresponding mark on a stick they carry, getting paid 50 cents a tree for every one they find. Wages average from 10 dols. to 12 dols. a month and "found." The wood is all shipped to English markets, bringing now from 120 dols. to 300 dols. per 1,000 feet. Dishonest measurements and low prices prevent them from shipping the wood to United States markets.

When we reached Livingston we went ashore with a Mr. Ford, mahogany cutter, who handles about 500,000 feet annually. He gets his timber out entirely by manual labour; hauling it on skids by the natives from one-fourth to half a mile, floating it to the port.

We arranged to take a trip up the Ulua River to Santiago. We went about 50 miles the first day through an almost unbroken wilderness of tropic foliage and scenery. The soil is a rich, dark loam, and looks capable of producing to an unlimited extent. Followed a mahogany road about a mile into the woods. Found the road good and the land very rich, and mainly level, covered mostly with a growth of small corosa palm, and very easily cultivated, and ought to be cleared at a cost not exceeding 5 dols. per acre. The Ulua passes through the great plain of Lula, which is about 70 miles long and 30 miles wide, and has been formed by the washings of ages from the mountains that surround it, making one of the richest and most productive soils on the earth's surface; everything being planted by simply cutting down and burning the bush, then making a hole with a sharp stick and dropping the seed into it.

About 65 miles up the river we came to the village of Urraco, situated on a high bluff. The entire village turned out to greet us, some naked, and the balance but thinly clad. A mahogany bank is located here, and we saw several fine logs squared ready to ship. A novel sight seen here was eight men running a cross-cut saw cutting the end of a log, and the ninth

man standing on the log bossing the other eight. Two men had hold of the handles, one at each, and the other six, three on each side, were pulling ropes attached to the handles of the saw.

We passed several mahogany banks and rafts during the day and at dark tied up at Plya Padre, near the mahogany bank of Mr. Bain. His foreman informed us that in 1882 they cut 500 logs, 200,000 feet, and expects to cut 600 logs this year, equal to 250,000 feet, at a cost of 12,000 dols. He employs forty men in the winter and twenty in the summer.

While the boat was taking on mahogany blocks for fuel, we took a stroll of about 2 miles into the woods over a well-constructed logging road. Saw stumps of several mahogany and cedar trees that had been cut, and found that the oft-repeated statement that from 10 to 15 feet of the choicest timber was left in the stump and entirely wasted is false, and that, on the contrary, the trees were cut within from 3 to 6 feet of the ground on an average, and only when an occasional tree would grow with long and narrow roots (similar to cypress knees) above ground were the stumps of greater height, and in such cases but little valuable timber was left standing.

We all rode over to see Lake Yojoa ; by riding to the top of a high peak we got a full view of the lake, which is about 20 miles long and 10 miles wide, and, with the exception of a small valley at each end, is surrounded by mountains 1,200 to 1,500 feet high. The lake is surrounded by dense woods on all sides, excepting about 10 miles of the shore on the north-east end. Saw several mahogany trees on the shore, and measured one that was about 7 feet in diameter.

We took an early start next morning, to explore the lake in canoes ; six of us got into one and rowed along the shore to the extreme south-west, stopping several times to examine the mahogany and cedar trees, which grew plentifully along the banks and far up on the mountain side. At one place we found an Indian making a canoe out of a mahogany tree which would have made 3,000 feet of choice lumber.

Two others and myself, on mule-back, ascended the Cumbra Peak, about 1,500 feet above San Pedro, and obtained an excellent view of the great Sula Plain, which stretches out as far as the eye can reach, with the Ulua and Chamelicon Rivers, from 5 to 18 miles apart, making a serpentine course through it to the sea.

After describing the various other features of the country, the writer concludes as follows :—To sum up, we have travelled 150 miles up the Ulua River through a plain of boundless wealth in soil and forests. The valuable woods have been cut but a few miles back from its banks, while they extend 10 to 20 miles to the well-timbered foot hills and mountains. The same plain extends to Yojoa, gradually increasing in altitude to

a height of 1,000 feet; while another but smaller plain extends from the north-east shore of Lake Yojoa, to the Blanco River, with occasional interruptions, equally as productive; and yet another on the south-west end of the lake, gradually rising till it reaches Santa Barbara. The same plain of Sula extends from 2 to 18 miles west of the Chamelicon; so that within a distance of 100 miles of the sea a great variety of climate and soil is found, with as healthy a climate as can be found anywhere. We have travelled over a large portion of the country by canoe, mule, and railroad, through the low lands, over mountains, and in the bush, and have used every means of obtaining information concerning the timber and agricultural resources of the country, and are thoroughly convinced that with sufficient capital, well directed, either or both can be carried on at an immense profit.—*Timber Trades Journal.*

We learn that French ingenuity has hit upon a plan to substitute other woods for mahogany, by the following process, and which might be practised on birch, ash, lime, &c., with every prospect of success. The first operation is to plane the surface of any species of close-grained wood until it is perfectly smooth, and then rub it with diluted nitrous acid, to prepare it for the materials to be subsequently applied. These consist of one-and-a-half ounces of dragon's blood, dissolved in a pint of spirits of wine, and one-third of that quantity of carbonate of soda, mixed together and filtered; the liquid in this state is then laid upon the wood with a soft brush, and when dry the application is repeated, with very little alteration, till the wood possesses all the appearance of mahogany.

A Swedish Match Factory.—At Jonkoping, Sweden, is the oldest and largest match factory in the world. It was established 100 years ago, and there are now to be seen specimens of the matches used at the beginning of the present century, consisting of big fagots of wood furnished with a handle and a tip to dip in a bath of sulphur. The wood from which the present kind of matches is made is taken from the adjacent forests, which are divided into fifty sections. Every year one section is cut and then replanted with young trees. The trees are hewed into planks in the forest and cut into slivers in the factory. The boxes are made of the outside of the trees. The factories are on the banks of lakes which are connected with one another by wide canals. Millions of matches are turned out each day. Some idea of where they all go to may be obtained from the statement that there are at least 280,000,000 of matches burned each day in the United States, or an average of five matches for each person.—*Timber Trades Journal.*

THAT LOG!—The great French walnut log brought across the waters by L. Hirsch and Brother, New York City, says the *Chicago Lumberman,* was recently cut in two, and half of it made into veneers. A twelve foot cross-cut saw was especially made to cut it, but in a half day it was broken, and a larger one made. Two days of constant sawing were required to complete the job. Then the log had to be quartered, because the largest veneer knife was not equal to the emergency. The veneers made from the log are described as having a handsome black and orange colour, and beautifully figured. The quarter that was cut contained about 12,000 feet of veneers, which is a basis for estimating the contents of the whole log at 96,000 feet.—*Timber Trades Journal.*

THE FOREST ACT IN BOMBAY.—The ryots in the Colaba collectorate, to the number it is represented of about twenty-six thousand, have lately petitioned the authorities for an alteration of the Indian Forest Act of 1878. The ryotwari complain with a good deal of bitterness of the rules framed by the Bombay Government under the Act, by which it appears they are debarred from utilising the forest produce—loppings, dried leaves, and fuel—for what is called *rab*, or the burning of their fields preparatory to their cultivation; and they ask to be reinstated in their immemorial privileges in respect of the forest and jungle generally. Taxation, already oppressive enough, is, they point out in their petition, onerously increased by the present rules, and a tax of one rupee per cartload of thorny bushes for making fences and for purposes of *rab* is urged as a specific hardship of magnitude.—*Pioneer.*

V. Extracts from Official Gazettes.

1.—Gazette of India—

No. 963.—*The 28th December, 1883.*—*Mr. J. L. Pigot*, who has been appointed by Her Majesty's Secretary of State to the Forest Department of India, is appointed an Assistant Conservator of Forests of the 3rd grade.

Mr. Pigot is posted to the Punjab, and his appointment will have effect from the 14th December, 1883.

No. 1 I.-E.—*The 1st January, 1884.*—Her Majesty the Queen and Empress of India has been pleased to appoint the undermentioned gentlemen, who by their services have merited the Royal favor, to be Companions of the Order of the Indian Empire :—

* * * * *

Baden Henry Baden-Powell, Esq., Bengal Civil Service, Additional Commissioner, Rawalpindi and Lahore Divisions.

2.—Calcutta Gazette—

The 3rd January, 1884.—With effect from the 1st September, 1883, during the absence of *Mr. G. W. Strettell*, Deputy Conservator of Forests, 1st grade, on privilege leave—

Mr. G. A. Richardson, Deputy Conservator of Forests, 3rd grade, to officiate in the 2nd grade.

Mr. F. B. Manson, Deputy Conservator of Forests, 4th grade, to officiate in the 3rd grade.

The 15th January, 1884.—*Mr. W. M. Green*, Officiating Deputy Conservator of Forests, Chittagong Division, is allowed privilege leave for one month with effect from the 21st December, 1883.

3.—North-West Provinces and Oudh Gazette—

No. 12.—*The 11th January, 1884.*—With effect from the 1st October, 1883, the date on which *Mr. C. Bagshawe* assumed charge of the office of Conservator, Central Circle—

Mr. E. McA. Moir, Deputy Conservator, 3rd grade, to officiate as Deputy Conservator, 2nd grade.

Mr. N. Hearle, Officiating Deputy Conservator, 4th grade, to officiate as Deputy Conservator, 3rd grade.

No. 13.—With effect from the the 14th October, 1883, the date on which Major J. E. Campbell returned from leave to Europe—

Major J. E. Campbell, Deputy Conservator, 3rd grade, to officiate as Deputy Conservator, 2nd grade.

Mr. E. McA. Moir, Officiating Deputy Conservator, 2nd grade, to revert to his substantive appointment as Deputy Conservator, 3rd grade.

Mr N. Hearle, Officiating Deputy Conservator, 3id grade, to officiate as Deputy Conservator, 4th grade.

No. 14.—With effect from the 10th November, 1883, the date on which *Mr. G. Greig* resumed charge of the office of Conservator of Forests, Central Circle, on his return from privilege leave—

Mr. C. Bayshawe, Officiating Conservator, to revert to his substantive appointment as Deputy Conservator, 2nd grade.

Major J. E. Campbell, Officiating Deputy Conservator, 2nd grade, to revert to his substantive appointment as Deputy Conservator, 3rd grade.

Mr. A. Smythies, Officiating Deputy Conservator, 3rd grade, to revert to his substantive appointment as Deputy Conservator, 4th grade.

No. 15.—With effect from the 1st December, 1883, consequent on the return from privilege leave of *Mr. J M. Braidwood*, Officiating Deputy Conservator, 3rd grade—

Mr. E. P Dansey, Officiating Deputy Conservator, 3rd grade, to revert to his substantive appointment as Deputy Conservator, 4th grade.

Mr. A. F Broun, Officiating Deputy Conservator, 4th grade, to revert to his substantive appointment as Assistant Conservator, 1st grade.

No. 44.—*The 22nd January, 1884.—Errata*—In the Notification issued from this Department, No. 1027, dated 28th December, 1883, *for* "with effect from the 1st October, 1883, *vice Mr. W. R. J Brereton*, promoted," *read* "with effect from the 28th September, 1883, *vice Mr. J. E. O'Callaghan*, retired."

4.—PUNJAB GAZETTE—

No 1.—*The 2nd January, 1884.*—With reference to *Punjab Government Gazette* Notification No 377, dated the 3rd September, 1883, it is hereby notified that *Mr. W. E. D'Arcy*, Deputy Conservator of Forests, returned to duty in this Province on the forenoon of the 11th December, 1883

No. 9 —*The 8th January, 1884* —*Mr. A. M. Reuther*, Assistant Conservator of Forests, Jhelum Division, is granted privilege leave of absence for 3 months, with effect from the 17th December, 1883.

No. 10 —*Mr. W. E. D'Arcy*, Deputy Conservator of Forests, is placed in charge of the Jhelum (Forest) Division with effect from the 17th December, 1883, relieving *Mr. A. M. Reuther*, Assistant Conservator of Forests, proceeded on leave.

5 —CENTRAL PROVINCES GAZETTE—

No. 143.—*The 9th January, 1884* —The one month's privilege leave granted to *Mr. Chundar Kumar Chatterji*, Sub-Assistant Conservator of Forests, by Notification No. 5038, of the 20th November, 1883, is hereby cancelled.

No. 368.—*The 24th January, 1884.—Mr. H. B. Anthony* is promoted from the 3rd to the 2nd grade of Assistant Conservators of Forests, with effect from 26th May, 1883.

6.—British Burma Gazette—

Nil.

7.—Assam Gazette—

Nil.

8.—Mysore Gazette—

Nil.

9.—Madras Gazette—

The 22nd December, 1883.—Mr. A. C. Colville, is appointed Forest Ranger, 5th grade, (Supernumerary,) on probation, and posted to the Salem District.

No. 4.—*The 8th January, 1884.—Mr. T. Sheffield,* Deputy Conservator of Forests, Old Scale, to be Assistant Conservator of Forests, 1st grade.

10.—Bombay Gazette—

The 8th January, 1884.—Mr. Waman Ramchandra Gaunde, who was appointed *pro tem.* Sub-Assistant Conservator of Forests, Belgaum, in Government Resolution No. 7762 of the 19th October, 1883, reported himself to the District Forest Officer, Belgaum, on the 3rd ultimo, before office hours.

Mr. W. R. Gaunde, transferred to the Northern Division in Government Resolution No. 8693 of the 27th November last, made over charge of his office to the Forester of Belgaum on the 17th ultimo, after office hours.

Messrs. J. M. Fernandez and *M. D'Cruz,* respectively delivered over and received charge of the office of the Sub-Assistant Conservator of Forests, Northern Division of Kánara, Kárwár, on the 15th ultimo, after office hours.

The 11th January, 1884.—Mr. H. W. Keys, Assistant Conservator of Forests, 3rd grade, reported himself for duty to the Conservator of Forests, Northern Division, on the 25th December, 1883, before noon, as directed in Government Resolution No. 9552, dated 27th December, 1883, in the Revenue Department.

The 12th January, 1884.—Mr. Waman Ramchandra Gaunde, substantive *pro tem.* Sub-Assistant Conservator of Forests, reported himself for duty to *Mr. A. D. Wilkins,* District Forest Officer, North and South Thána, on the 5th January, 1884, after office hours, and assumed charge of the following Ranges of the Thána District :—

1, Sálsette. 2, Kalyán. 3, Murbád. 4, Karjat. 5, Khálápur.

No. 571.—*The 22nd January, 1884.—Mr. H. Murray,* Assistant Conservator of Forests, 3rd grade, is promoted to the 2nd grade, with effect from 8th October, 1883.